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A CRITIQUE OF INDEX NUMBERS OF THE PRICES OF STOCKS

In recent years index numbers of stock prices have gained general acceptance: they are regularly "carried" by the financial press; they are watched by bankers, investors, and speculators; they are put before railway commissions and courts as evidence; they are used in many ways by publicists and economists. This acceptance, however, is not the result of critical approval. Perhaps the good repute which index numbers of commodity prices at wholesale have fairly won after long discussion has disposed most "consumers of statistics" to trust index numbers as such. But apart from any special justification, there certainly prevails an amiable willingness to take upon faith plausible figures that fill a pressing want. And the stock index numbers have been published in the form that makes new figures most alluring—the paucity of explanations and warnings has encouraged readers to use or misuse the results without undergoing the mental toil of criticism or the moral strain of doubt. As for the cautious minority, they have been foiled by this same simplicity of presentation; they have been given few materials wherewith to determine the representative value of the original quotations, to judge the appropriateness of the methods used, or to compare the results of rival series.

To test the value of these popular figures is the aim of this paper. The method chosen is to put side by side several index

numbers of stocks, old and new, to compare the differences among them with the corresponding differences among commodity indexes, to trace these differences to their sources in dissimilarities of data and methods, and finally to show which among the numerous forms of stock indexes is best for general use.

This plan of starting with the familiar figures now in common use and of proceeding in an empirical fashion to inquire what, if anything, is the matter with them, has the merits of a direct attack upon the concrete problem of chief interest. But on the other hand, the discussion developed along this line becomes discursive rather than systematic. All the usual questions concerning the construction of index numbers are faced at some stage of the inquiry—the use of relative or actual prices, the choice of averages, the problem of weighting, etc.; but the order in which these questions are faced is a matter rather of convenience than of predestination. The whole performance, indeed, has the defects of an experimental as opposed to a mathematical way of finding and dealing with problems.

This procedure would scarcely be feasible unless a general acquaintance with index numbers could be taken for granted. But with a background of such knowledge fixed in the minds of readers, it should be possible to turn our eyes now toward one, now toward another feature of the foreground without becoming confused. For this foreground represents merely the application of devices that have proved their value for measuring the price fluctuations of commodities to the more difficult task of measuring the price fluctuations of stocks. The sole preliminaries called for are a brief discussion of fundamental differences between these two classes of goods and a still briefer reference to the uses for which stock indexes are made.[1]

I. THE FUNDAMENTAL DIFFERENCE BETWEEN STOCK AND COMMODITY INDEX NUMBERS

In several respects stock prices are more satisfactory data for statistical analysis than commodity prices. Stock dealings are more highly centralized and more thoroughly organized than deal-

[1] The writer's hearty thanks are due to Professor James A. Field for generous suggestions and criticisms, by which he has profited in revising the first draft of this paper.

ings in most commodities. The prices are reported with unexcelled fulness and accuracy. While the number of stocks for which frequent and regular quotations can be collected for considerable periods is less than the corresponding number of commodities at wholesale, it doubtless forms a larger proportion of the whole list dealt in. Once more, stocks are quoted in terms of a nominally uniform unit—the share with a par value of $100, or some multiple that can readily be changed into the standard unit. Hence the actual prices can be compared, summed, and averaged with a facility lacking when one handles commodity prices. Concerning the authenticity and the representative character of stock quotations, in short, there are fewer doubts than haunt the mind of the field-worker in a commodity-price investigation.

It is when one begins to interpret these quotations that doubts become grave. First there is the familiar question: What does the share with a par value of $100 really mean? Second, there is the assurance that whatever that unit in one corporation means this year, it will probably mean something different next year. Commodities are tangible substances, measured by physical units, and in making index numbers one rejects articles that are not substantially uniform in quality over long periods. Business enterprises, on the contrary, are essentially variable entities, and shares in them are subject to changes that affect the enterprises, and to other changes as well. The Pennsylvania Railroad, for example, is a remarkably stable corporation; yet its physical property, its security holdings, its leases, its indebtedness, its earnings and expenses, its financial affiliations, its relations to regulating commissions, and a hundred other matters that affect the market value of its shares, all vary constantly or intermittently. To cite only one crude gauge: the Pennsylvania system counted about 7,600 miles of railway in 1890 and about 11,800 miles in 1915. And in this changing property a share of common stock in 1890 represented ownership of one part in 2,451,354, whereas in 1915 one share represented ownership of one part in 9,985,314. Stocks, then, are variable fractions of variable wholes, and their prices fluctuate incessantly because of changes *in the thing quoted*, as well as for other reasons.

From such facts it is sometimes inferred that index numbers of stock prices have no valid use except for short-period comparisons; or that an index number covering decades is no better when it excludes than when it admits numerous substitutions of one stock for another. In any case, the argument runs, comparisons of stock prices in years far apart are comparisons of dissimilar goods: they are like comparisons of the prices of potatoes and silk in 1890 with the prices of pig iron and tea in 1915.

Such conclusions, however, are rash. The fact that stocks change as commodities do not, proves merely that stock index numbers must not be interpreted as meaning precisely what commodity indexes mean. It does not prove that stock indexes are meaningless, or that alterations in the list of securities included in them are unobjectionable. Business enterprises, indeed, are more like men than they are like commodities. Commodities are produced and consumed; then produced afresh in the old forms. Business enterprises have a continuous life; they undergo great changes of expansion, contraction, even reorganization, without losing their identity. And this continuity of business enterprises and of shares in them is a fact of great practical importance. The many individuals and corporations that hold stock in the same business enterprises for years at a time are deeply concerned with long-period changes in the prices of their securities. The like holds true with reference to the "investing public" as a unit, and to its security holdings as an aggregate. Even the wider public in its efforts to regulate corporation charges and corporation finance through governmental commissions needs to know the course followed by security prices in particular and in general. The fluctuations of New Haven stock between the early nineties and the present are not rated a matter of indifference; neither are the very different fluctuations of Pennsylvania stock, nor the still different fluctuations of Lackawanna. Nor is it unimportant to find out which type of fluctuations has been characteristic of American stocks at large.

Stock indexes, then, differ from commodity index numbers in that they show, not variations in the prices of unvarying goods, but variations in the prices of goods that maintain their identity

despite continual changes in quality. This difference enhances the difficulty both of making and of using them; but it does not destroy their logical legitimacy or their practical importance.

With the many other differences between stocks and commodities we have slight present concern. Were it our task to explain the facts which index numbers reveal we should have to go at length into the peculiarities presented by the demand for, and the supply of, stocks. But in measuring given phenomena it is seldom necessary to know their causes in advance. On the contrary, measuring is generally a most important preliminary in conducting a search for causes, and so we should find it in this case, were we trying to account for the course of the stock market. What we do need to be sure of in advance is that our measures shall have meaning and use when they are made. Doubts on the first head having been set aside, we turn to the second.

II. THE USES OF STOCK INDEX NUMBERS

An index number is a statistical device made to serve certain ends. Hence the logical first step toward an evaluation of any such series is to define precisely the end which the finished results are to serve. That done, one has a criterion by which to judge the merits and defects of the series already in use and by which to guide his own efforts in making new series.

The trouble with this seemingly promising lead is that stock index numbers are put to so many and such varied uses as to give little help in defining what is wanted. An economist may seek to measure changes in the purchasing power of money over stocks; a speculator may wish to forecast the probable future course of the market, a public commission may be interested in the terms on which corporations can raise new capital, a publicist may investigate the claim that government regulation has brought loss upon investors, a financial historian may wish to mark off periods of expansion and contraction, a trustee may inquire whether the fluctuations of his security holdings have compared favorably with the average course of the market, an insurance company may seek light on the probable future of interest rates, a student may wish to compare stock fluctuations with the price fluctuations of

commodities at wholesale or retail, of labor, of bonds, of farm lands, of securities in other countries, etc. Now, each one of these people will have use for a stock index. But the more carefully these various uses are analyzed, the clearer it becomes that their requirements differ. The character and the number of stocks to be included, the frequency of the quotations needed, the period of time covered, whether actual or relative prices should be used, the desirability of making subgroups and their basis, the kind of average appropriate, the necessity of considering deviations from the mean, whether weights should be introduced and if so what is the proper criterion of "importance"—these and the other points of technique that arise in making an index number would not all be decided precisely alike in any two of the cases suggested, did uses strictly dictate methods—as logically they should.

Ideally, every distinct use should have a distinct index number especially designed for it. Practically, however, cases are few when the consumer of statistics has the technical skill and can spend the time and money to make a series exactly answering his needs. What happens is that he uses for his special purposes one of the series published by others—more often than not without realizing that the figures in question are in certain respects ill adapted to his needs. Frequently the user does not even hit upon that one among the published series which is least unsuited to his case. And this situation promises to change but slowly. Probably the published series will long continue to be used as "general-purpose" index numbers. And a "general-purpose" index number is too indefinite a conception to guide one surely through the maze of choices that are involved in making a new series or in ranking old ones.

Under these confusing circumstances, what can we attempt with any prospect of success? We cannot discuss the merits of stock index numbers at large with reference to their uses, because these uses and their several requirements are so multifarious. Our best hope seems to lie in reversing the problem. That is, we can analyze stock index numbers, old and new, to find of what

materials and by what methods they are made. Then we can discuss their uses with reference to their construction. Finally, we can determine what fluctuations in the prices of stocks can be measured most accurately and by what means. The index number which stands first in this test will have special claims to acceptance, except for uses which require some radically different series, less accurate though it be.[1]

III. A COMPARISON OF DIFFERENT INDEX NUMBERS OF THE PRICES OF AMERICAN STOCKS IN 1890–1915

Tables I, II, and III place side by side several index numbers of stocks in form proper for comparison. The first table shows annual averages of actual prices in dollars and cents; the second shows percentages of rise or fall in price from one year to the next; the third shows relative prices on the base: average actual prices in 1890–99 = 100. A few words of explanation concerning the different series will make their meaning clear.

When I began studying business cycles, I needed a measure of the fluctuations in the prices of stocks, comparable with the existing index numbers of commodity and labor prices. The most comprehensive tables of the latter sorts were those published by the United States Bureau of Labor Statistics. At that time the Bureau's index numbers were simple arithmetic means of relative prices computed on the base: average actual prices in 1890–99 = 100.0. Accordingly I adapted the new index number of stock prices to the Bureau's model. This series was brought down to date in the February, 1916, issue of the *Journal of Political Economy*, and is reproduced in Table III, column 2. It includes the common stocks of thirty-five railways and five express, steamship, and telegraph companies. Two figures—averages of the highest and lowest relative prices—have been published for each month, quarter, and year in 1890–1915; but in this paper only the annual averages are used—arithmetic means made from the twenty-four

[1] Compare the corresponding section in "The Making and Using of Index Numbers," *Bulletin of the United States Bureau of Labor Statistics*, Whole No. 173.

TABLE I

EIGHT INDEX NUMBERS OF THE AVERAGE ACTUAL PRICES OF STOCKS ON THE NEW YORK STOCK EXCHANGE. BY YEARS: 1890–1915

(For explanations of the several series, see the accompanying text)

	Forty Transportation Stocks						Twenty Railway Stocks; *Wall Street Journal* Series	All Stocks Sold on the New York Stock Exchange
	Simple Averages			Weighted Averages				
				Arithmetic Means Weighted by				
	Geometric Means (1)	Medians (2)	Arithmetic Means (3)	Stock Outstanding (4)	Earnings (5)	Number of Shares Sold (6)	(7)	(8)
1890	$40.68	$40.20	$61.16	$70.47	$76.37	$54.96	$65.62*	$60.20
1891	38.98	35.75	57.87	67.16	73.13	49.25	62.82*	57.10
1892	43.18	45.50	62.18	71.75	78.21	54.69	71.32*	63.50
1893	33.28	26.65	52.71	60.95	67.03	40.24	58.45*	60.30
1894	28.64	19.60	48.55	55.35	61.12	32.70	52.67*	64.20
1895	29.83	24.30	49.28	56.22	61.75	32.67	53.79*	60.30
1896	26.91	20.15	46.36	53.70	59.26	31.39	50.38*	65.20
1897	28.46	23.70	49.06	57.03	62.92	35.79	56.25	67.00
1898	31.85	32.05	54.36	63.67	70.39	42.68	65.29	72.70
1899	44.04	49.25	66.48	76.49	84.44	55.77	82.11	78.60
1900	45.26	52.15	67.67	77.55	85.80	58.11	79.60	69.20
1901	70.13	76.80	90.69	100.11	110.13	88.09	107.83	79.00
1902	82.86	91.70	105.48	111.85	125.29	99.38	119.36	79.90
1903	67.28	74.30	89.65	95.22	107.13	83.62	102.84	73.20
1904	64.84	71.50	89.44	94.82	107.10	86.00	102.38	69.90
1905	81.59	90.10	108.60	115.77	129.76	113.16	125.33	87.30
1906	86.86	93.20	117.42	122.15	137.84	126.97	131.24	94.20
1907	65.27	74.60	95.41	101.35	114.86	102.69	103.28	85.80
1908	62.90	72.35	94.78	100.39	114.66	106.44	102.15	86.60
1909	84.85	92.25	120.10	125.09	142.12	136.66	125.47	97.50
1910	75.10	98.20	108.77	116.71	130.70	126.85	117.21	96.20

1911	71.05	95.30	105.80	115.42	128.10	124.96	117.53	95.80
1912	68.01	96.45	106.83	116.87	129.45	124.97	119.57	97.70
1913	54.67	78.35	89.33	101.37	110.86	112.88	107.65	96.20
1914	43.95	65.35	79.44	90.07	98.85	102.23	97.35†	93.20‡
1915	43.53	67.90	80.56	90.72	99.69	100.51	87.01	85.10
Averages								
1890–1899	34.59	31.72	54.80	63.28	69.46	43.01	61.87	64.91
1900–1909	71.18	78.90	97.92	104.43	117.47	100.11	109.95	82.26
1910–1915	59.39	83.59	95.12	105.19	116.28	115.40	107.72	94.03
1890–1915	54.39	61.82	80.69	88.77	98.73	81.68	90.95	78.30

* Computed from monthly lowest and highest prices of stocks in the *Wall Street Journal's* list as constituted in 1897.

† Lowest prices of July used for August to November, inclusive, when the Stock Exchange was closed.

‡ No transactions July 31 to December 11, inclusive.

TABLE II

TEN INDEX NUMBERS SHOWING THE PERCENTAGES OF RISE (+) OR FALL (−) IN THE PRICES OF STOCKS FROM ONE YEAR TO THE NEXT ON THE NEW YORK STOCK EXCHANGE. BY YEARS: 1890–91 TO 1914–15

(For explanations of the several series, see the accompanying text)

	Forty Transportation Stocks								Twenty Railway Stocks; *Wall Street Journal* Series from Table I	All Stocks Sold on the New York Stock Exchange from Table I
	Series Made from the Percentages of Rise or Fall in the Average Yearly Prices of Each Stock		Series Made from the Average Actual Prices Shown in Table I							
			Simple Averages			Weighted Averages				
						Arithmetic Means Weighted by				
	Medians (1)	Arithmetic Means (2)	Geometric Means (3)	Medians (4)	Arithmetic Means (5)	Stock Outstanding (6)	Earnings (7)	Number of Shares Sold (8)	(9)	(10)
	Per Cent	Per Cent	Per Cent	Per Cent	Per Cent	Per Cent	Per Cent	Per Cent	Per Cent	Per Cent
1890–91	− 3.3	− 2.7	− 4.2	−11.1	− 5.4	− 4.7	− 4.2	−10.4	− 4.3	− 5.1
1891–92	+ 6.9	+13.7	+10.8	+27.3	+ 7.4	+ 6.8	+ 6.9	+11.0	+13.5	+11.2
1892–93	−16.8	−21.4	−22.9	−41.4	−15.2	−15.0	−14.3	−26.4	−18.0	− 5.0
1893–94	−10.9	−12.1	−13.9	−26.4	− 7.9	− 9.2	− 8.8	−18.7	− 9.9	+ 6.5
1894–95	+ 4.3	+ 7.0	+ 4.2	+24.0	+ 1.5	+ 1.6	+ 1.0	− 0.1	+ 2.1	− 6.1
1895–96	−10.5	− 8.1	− 9.8	−17.1	− 5.9	− 4.5	− 4.0	− 3.9	− 6.3	+ 8.1
1896–97	+ 6.2	+10.4	+ 5.7	+17.6	+ 5.8	+ 6.2	+ 6.2	+14.0	+11.6	+ 2.8
1897–98	+ 9.7	+14.5	+11.9	+35.2	+10.8	+11.6	+11.9	+19.2	+16.1	+ 8.5
1898–99	+24.5	+49.7	+38.3	+53.6	+22.3	+20.1	+20.0	+30.7	+25.7	+ 8.1
1899–1900	+ 0.2	+ 4.1	+ 2.8	+ 5.9	+ 1.8	+ 1.4	+ 1.6	+ 4.2	− 3.1	−12.0
1900–1	+43.3	+61.7	+54.9	+47.3	+34.0	+29.1	+28.3	+51.6	+35.5	+14.2
1901–2	+16.1	+19.3	+18.1	+19.4	+16.3	+11.7	+13.8	+12.8	+10.7	+ 1.1
1902–3	−17.0	−18.1	−18.8	−19.0	−15.0	−14.9	−14.6	−15.9	−13.9	− 8.4
1903–4	− 2.1	− 3.1	− 3.6	− 3.8	− 0.2	− 0.4	± 0.0	+ 2.8	− 0.5	− 4.5
1904–5	+24.3	+28.0	+25.8	+26.0	+21.4	+22.1	+21.2	+31.6	+22.4	+24.9
1905–6	+ 3.4	+ 7.8	+ 6.5	+ 3.5	+ 8.1	+ 5.5	+ 6.2	+12.2	+ 4.7	+ 7.9

1906–7.....	−22.4	−23.8	−24.8	−20.0	−18.7	−17.0	−16.7	−19.3	−21.3	− 8.9
1907–8.....	− 3.4	− 2.9	− 3.6	− 3.0	− 0.7	− 0.9	− 0.2	+ 3.7	− 1.1	+ 0.9
1908–9.....	+30.3	+37.1	+34.9	+27.5	+26.7	+24.6	+23.9	+28.4	+22.8	+12.6
1909–10.....	− 7.0	−10.0	−11.5	+ 6.5	− 9.4	− 6.7	− 8.0	− 7.2	− 6.6	− 1.3
1910–11.....	− 5.1	− 4.8	− 5.4	− 3.0	− 2.7	− 1.1	− 2.0	− 1.5	+ 0.3	− 0.4
1911–12.....	− 2.1	− 2.3	− 4.3	+ 1.2	+ 1.0	+ 1.3	+ 1.1	± 0.0	+ 1.7	+ 2.0
1912–13.....	−17.2	−18.8	−19.6	−18.8	−16.4	−13.3	−14.4	− 9.7	−10.0	− 1.5
1913–14.....	−14.2	−17.5	−19.6	−16.6	−11.1	−11.1	−10.8	− 9.4	− 9.6	− 3.1
1914–15.....	− 0.4	+ 1.2	− 1.0	+ 3.9	+ 1.4	+ 0.7	+ 0.9	− 1.8	−10.6	− 8.7
Averages										
1890–1900....	9.3	14.4	12.5	26.0	8.4	8.1	7.9	13.9	11.1	7.3
1900–1910....	16.9	21.2	20.3	17.6	15.1	13.3	13.3	18.6	14.0	8.5
1910–1915....	7.8	8.9	10.0	8.7	6.5	5.5	5.8	4.5	6.4	3.1
1890–1915....	12.1	16.0	15.1	19.2	10.7	9.7	9.6	13.9	11.3	7.0

TABLE III

ELEVEN INDEX NUMBERS SHOWING THE RELATIVE PRICES OF STOCKS ON THE BASIS: AVERAGE ACTUAL PRICES IN 1890–99 = 100. BY YEARS: 1890–1915

(For explanations of the several series, see the accompanying text)

	Forty Transportation Stocks								Forty Common and Ten Preferred Stocks; Arithmetic Means of Relative Prices	Twenty Railway Stocks; *Wall Street Journal* Series from Table I	All Stocks Sold on the New York Stock Exchange from Table I
	Series Made from the Relative Prices of Each Stock		Series Made from the Average Actual Prices Shown in Table I								
			Simple Averages			Weighted Averages					
						Arithmetic Means Weighted by					
	Medians (1)	Arithmetic Means (2)	Geometric Means (3)	Medians (4)	Arithmetic Means (5)	Stock Outstanding (6)	Earnings (7)	Number of Shares Sold (8)	(9)	(10)	(11)
1890	110	121	118	127	112	111	110	128	118	106	93
1891	108	113	113	113	106	106	105	115	111	102	*88*
1892	115	123	125	143	113	113	113	127	121	115	98
1893	95	93	96	84	96	96	97	94	92	94	93
1894	88	82	83	*62*	89	87	88	76	82	85	99
1895	89	85	86	77	90	89	89	76	86	87	93
1896	*82*	77	*78*	64	*85*	*85*	*85*	*73*	*79*	*81*	100
1897	89	84	82	75	90	90	91	83	86	91	103
1898	93	94	92	101	99	101	101	99	97	106	112
1899	117	128	127	155	121	121	122	130	129	133	121
1900	125	134	131	164	123	123	124	135	134	129	107
1901	189	211	203	242	165	158	159	205	204	174	122
1902	220	250	240	289	193	177	180	231	238	193	123
1903	184	201	195	234	164	150	154	194	193	166	113
1904	172	192	187	225	163	150	154	200	185	165	108
1905	241	250	236	284	198	183	187	263	236	203	134
1906	238	267	*251*	294	214	193	198	295	250	*212*	145

1907.....	179	204	189	235	174	160	165	239	191	167	132
1908.....	170	201	182	228	173	159	165	248	187	165	133
1909.....	*249*	*277*	245	291	*219*	*198*	*205*	*318*	*255*	203	150
1910.....	219	254	217	*310*	198	184	188	295	233	189	148
1911.....	188	248	205	300	193	182	184	291	226	190	148
1912.....	165	243	197	304	195	185	186	291	219	193	*151*
1913.....	125	206	158	247	163	160	160	262	186	174	148
1914.....	112	178	127	206	145	142	142	238	159	157	144
1915.....	110	180	126	214	147	143	144	234	161	141	131
Averages											
1890–1899....	99	100	100	100	100	100	100	100	100	100	100
1900–1909....	197	219	206	249	179	165	169	233	207	178	127
1910–1915....	153	218	172	264	174	166	167	268	197	174	145
1890–1915....	149	173	157	195	147	140	142	190	164	147	121
Net Rise (+) or Fall (−)											
1890–1896....	− 28	− 44	− 40	− 63	− 27	− 26	− 25	− 55	− 39	− 25	+ 7
1896–1909....	+167	+200	+167	+227	+134	+113	+120	+245	+176	+122	+ 50
1909–1915....	−139	− 97	−119	− 77	− 72	− 55	− 61	− 84	− 94	− 62	− 19
1890–1915....	= 0	+ 59	+ 8	+ 87	+ 35	+ 32	+ 34	+106	+ 43	+ 35	+ 38
Difference between highest and lowest....	167	200	173	248	134	113	120	245	176	131	63
Average change from one year to the next ...	23	24	23	30	15	13	13	23	22	16	8

NOTE.—The entries italicised in each series are the minimum and maximum.

monthly quotations (twelve high and twelve low) for each stock each year.[1]

In recent years, I have utilized the large body of data collected for this series to make twenty-one new index numbers. Of the new series, six are annual averages of actual prices made by first striking the arithmetic means of the highest and lowest monthly quotations to get the average yearly prices of each of the forty stocks, and then averaging these forty yearly figures in different ways. The results are shown in the first six columns of

[1] The list of stocks included in this series and certain facts concerning each are shown below in Tables VIII–X.

The source relied upon for the original data is the table of "Prices of Stocks at the New York Stock Exchange" published annually in the *Financial Review*. Two exceptions are to be noted: (1) Pennsylvania Railroad stock was not regularly quoted on the New York market until September, 1897. For earlier dates prices on the Philadelphia Exchange are used. (2) For October and November, 1914, when the New York market was closed, quotations are based on the prices given by brokers' circulars as digested by the *Financial Review*. The August and September figures in that year are made from the prices (largely bid and asked) of July 30. The quotations are prices on 100-share lots, and on par values of $100. Two such prices are used for each stock each month—namely the highest and the lowest recorded. In reducing these monthly figures to annual averages no attempt was made to supply missing quotations in earlier years—if no transactions occurred in a certain stock in one month of a year, its average price was made by casting up the 22 quotations for the remaining months and dividing by 22. Since 1911, however, such gaps in the data have been filled in by the use of bid and asked prices or by interpolation. No preferred stocks are included.

In the original investigation all the railway stocks were selected that had approximately complete and regular price records for the years 1890–1909. Several important lines, such as the Burlington, Lake Shore, Michigan Central, and Northern Pacific, were omitted because quotations were scanty or altogether lacking for one or more years. Other lines, like the Rock Island and the Alton, have undergone reorganizations which broke the continuity of their quotations. A similar break has resulted in the case of the Pullman Company, the Adams Express Company, etc., from the issue of large stock dividends. But stock dividends which did not force prices suddenly to a lower level and the payment of stock assessments which did not raise prices suddenly to a higher level were disregarded. If all stocks affected in any degree by such changes had been rejected the list remaining would have been short indeed. In railways undergoing reorganization, the prices of voting-trust certificates have frequently been used in lieu of the prices of shares. In no case, however, have the original quotations accepted been altered in any way to allow for "disturbing factors." Since the publication of the tables was begun in 1910, no changes have been made in the list of stocks.

For the full monthly and quarterly results see the *Journal of Political Economy*, XVIII, 345–80; XXI, 500–522; XXIV, 126–157.

Table I. Twelve more series are made by converting these same averages of actual prices into *relative* prices on two bases: first, prices in the preceding year = 100 (Table II, columns 3–8); second, average prices in 1890–99 = 100 (Table III, columns 3–8). The three remaining series made from my own collection of data (Table II, columns 1 and 2, Table III, column 1) are new averages of relative prices.

My reason for working the same data up in so many different ways was partly to find what effects are produced by various methods of computation, but mainly to secure series adapted to special uses. While my first stock index was appropriate for comparison with the other figures I had to use, it was open to criticism on technical grounds. The familiar objections to haphazard weighting, to arithmetic means, and to fixed-base relatives apply to index numbers of stock prices as well as to commodity indexes. But it was not until Dr. Royal Meeker determined to change the Bureau's commodity index numbers to weighted aggregates of actual prices, reduced to relatives on the last-completed-year base, that I had weighted aggregates (and averages) of actual prices made from my stock quotations. Three systems of weights were used: (1) average amounts of stock outstanding, (2) average earnings, (3) average number of shares sold, the averages in each case covering the twenty-five years 1890–1914. The results appear in Table I, columns 4, 5, and 6, while the weights are presented and their uses discussed in Section X, below.

Meanwhile a desire to compare my own figures with those published by the *Wall Street Journal* had led me to make the unweighted arithmetic means of actual prices (Table I, column 3). The original *Wall Street Journal* figures likewise had to be recast for the comparison. The long-period table published at intervals in that *Journal* shows the highest and lowest average prices of twenty railway stocks each month since 1897, except for the period in 1914 when the Stock Exchange was closed. I have (1) interpolated figures for these missing months on the assumption that stocks were "carried" at the prices of July 30, (2) reduced the monthly figures to annual averages, and (3) carried back the series from 1897 to 1890. It is to be noted that the list of stocks used has

undergone important changes since the series was begun.[1] The new version of this series appears in column 7 of Table I.

The medians of actual prices (column 2, Table I) are merely a by-product of a table made in studying the dispersion of the quotations (see Table XI below). The corresponding geometric means (column 1) were made less for themselves than as raw materials for striking a true average of ratios of change in the prices of stocks—of which more later. Finally, column 8 in this table was copied from the *Financial Review* for 1915, p. 51. This *Review* reports (1) the approximate actual values of all the stocks sold each year on the New York Stock Exchange, (2) the total par value of these stocks, and (3) the total number of shares sold. Experiment with the figures shows that the "average prices" here reproduced are computed by dividing the first of these values by the second. Of course the resulting series is a weighted average, and

[1] The following schedule shows the extent of these changes:

STOCKS INCLUDED IN THE *WALL SREET JOURNAL'S* AVERAGES OF TWENTY RAILWAY STOCKS

Included Both in 1897 and in 1915	Included in 1897 but Not in 1915	Included in 1915 but Not in 1897
1. Atchison	1. Lake Shore	1. Baltimore & Ohio
2. Chesapeake & Ohio	2. Burlington	2. Canadian Pacific
3. Erie	3. Rock Island	3. Delaware & Hudson
4. Louisville & Nashville	4. Central Railroad of New Jersey	4. Illinois Central
5. New York Central	5. Cleveland, Cincinnati, Chicago & St. Louis	5. Kansas City Southern
6. Reading	6. Missouri Pacific	6. Lehigh Valley
7. St. Paul	7. Chicago & Northwestern	7. New Haven
8. Northern Pacific	8. Wabash, preferred	8. Norfolk & Western
9. Southern Railway	9. Missouri, Kansas & Texas, preferred	9. Pennsylvania
	10. New York, Susquehanna & Western, preferred	10. Southern Pacific
	11. Manhattan Elevated	11. Union Pacific

For the backward extension of this series I used the monthly highest and lowest prices of the stocks in the list as it stood in 1897. One substitution was necessary because of lack of quotations: namely, Iowa Central preferred for Southern Railway preferred in January, 1890, to June, 1893. To reduce the effect of this change I multiplied the Iowa Central figures by 1.0453—the factor which makes the quotation for July, 1893, equal the price of Southern when it was first quoted.

Highest and lowest quotations for each stock each month, such as I took from the *Financial Review*, seldom yield precisely the same results as the highest and lowest daily averages for twenty stocks. As was to be expected, my new figures for the *Wall Street Journal* series in 1897 were one a little higher and the other a little lower than the *Journal's* figures: my average was 1.5 per cent higher. Hence I divided my new figures for 1890–96 by 1.015 to make as good a splice as possible.

My hearty thanks are due to Mr. Lockwood Barr, the editor of the *Wall Street Journal*, for information about the early history of his series.

one in which the weights change radically from year to year—that is, the larger the par value of the transactions in a given stock in a given year, the greater is the influence that stock exercises upon the average.

One great advantage of such averages of actual prices as are given in Table I is that they can be turned at will into relatives on any base desired.[1] To summarize: the eight indexes of the first table yield eight of the ten series of relatives in the second table, and eight of the eleven series of relatives in the third. The other series in Table II (columns 1 and 2) are made directly from the relative prices of each of the forty stocks, computed on the base: prices in the year before = 100. The same is true of columns 1 and 2 in Table III, except that the base in this case is average prices in the decade 1890–99. The one series left, column 9 in Table III, is similar in construction but different in materials; here relatives of ten preferred stocks are averaged with the relatives of forty common stocks employed in making column 2.[2]

IV. THE DIVERGENCES AMONG INDEX NUMBERS OF STOCKS AND AMONG INDEX NUMBERS OF COMMODITIES

The first test to be tried upon these index numbers of stock prices is the test of consistency. Elsewhere I have argued that we are justified in trusting our index numbers of commodity prices at wholesale, because series made by different men, from dissimilar data and by unlike methods, yield substantially similar results, and because the moderate discrepancies that do appear among them are consistent with what we know about the dissimilarities of fluctuation characteristic of different parts of the

[1] On the other hand, the index numbers made from averages of relative prices can be regarded as averages of actual prices made with a peculiar scheme of weights. (Compare F. R. Macaulay, "Index Numbers for Retail Prices," *American Economic Review*, V [December, 1915], 928, 929.) In that light, it is legitimate to turn them also into relatives on any base desired. The real objection to this procedure is that it becomes difficult to state clearly what such series mean after they have been shifted to a new base. The relation between relative prices and actual prices in this respect will be discussed more fully in section X below.

[2] This series was first published for 1890–1909 in this *Journal*, XVIII (July, 1910), 524. For the index numbers of preferred stocks see Table XX, column 2, below.

system of prices.[1] Can these reassuring conclusions be extended to index numbers of stock prices?

Certainly the series of actual prices (Table I) diverge notably from each other, even with respect to their broadest results—the twenty-six-year averages. The simple arithmetic means are 48 per cent higher than the corresponding geometric means, and 31 per cent higher than the medians made from precisely the same data. Weighting makes smaller but still considerable differences in results, the highest weighted series running 21 per cent above the lowest weighted series. While the latter series (No. 6) gives grand averages not 1.3 per cent greater than the corresponding simple arithmetic means (No. 3), that is the net result of large minus differences in the first half of the period offsetting large plus differences in the second half. Differences in the samples used make differences in the results, which though smaller again are still considerable: the twenty-six-year average of the *Wall Street Journal* series for twenty stocks is 13 per cent higher than the averages of the corresponding series for forty stocks (No. 3). Finally the combination of dissimilar samples and dissimilar weights yields differences in the averages which run from 4 to 26 per cent of the smaller series (No. 8 compared with Nos. 4, 5, and 6).

These differences, however, are a matter of small concern; for index numbers are intended to measure, not the average prices of stocks as such, but either the fluctuations of these average prices or average fluctuations in prices. Price fluctuations in the first of these senses can be followed more readily when the actual prices of Table I are turned into the relative prices of Tables II and III. Besides, the latter tables give additional series showing average fluctuations of prices, and also allow us to set commodity index numbers against our figures for stocks.

Do the stock indexes in the form of relative prices harmonize well with each other, as do the commodity indexes?

1. Concerning the *direction* in which prices move, stock indexes agree rather better than do commodity indexes. The eleven series of Table III all rise together or fall together in fourteen years;

[1] See "The Making and Using of Index Numbers," *Bulletin of the U.S. Bureau of Labor Statistics, No. 173*, especially pp. 112, 113.

they disagree in eleven years.[1] Two of the series, those made respectively from the medians of actual prices and from the prices of all stocks sold on the Exchange (Nos. 4 and 11), are most erratic as compared with the others. Leaving them out, we have agreement in seventeen years, disagreement in eight. A similar comparison of seven commodity indexes for 1890–1914 shows agreement in twelve years and disagreement in twelve.[2]

2. Stock indexes are more variable than commodity indexes in the sense that they show greater changes from one year to the next. When these changes are computed as percentages of prices in the preceding year (Table II), the ten series for stocks show average changes for twenty-five years ranging between 7 and 19 per cent. But the extremes are supplied by the two series found to be most erratic in the preceding comparison. Dropping them again, we have average variations of 10–16 per cent (Nos. 7 and 2). A similar computation for four commodity indexes on the preceding-year base yields the following averages: 3.6 per cent; 3.7 per cent; 4.6 per cent; 5.1 per cent.[3]

If these year-to-year changes are expressed as percentages of prices in 1890–99 (Table III), the figures for stocks run still higher: the extremes are now 8 and 30 per cent, or, after throwing out the two erratic series (Nos. 4 and 11 in this table), 13 and 24 per cent. Similar figures for eight commodity indexes show average changes varying from 4.0 to 7.9 per cent. Hence the most variable commodity series (Gibson's index of food prices) barely laps the steadiest of all the stock indexes, No. 11.[4]

[1] In a few cases where the change is so slight as not to appear on the coarse scale of relative prices used in Table III, reference is made to the actual prices of Table I to determine whether the trend was upward or downward.

[2] See *Bulletin of the U.S. Bureau of Labor Statistics, No. 173*, pp. 98, 99, for the results in 1890–1913. In 1914 the testimony is particularly conflicting.

[3] The series in question are, respectively, arithmetic means of the Bureau of Labor Statistics percentages of change from year to year (1890–1913), the Bureau's weighted aggregates of actual prices (1890–1914), Dun's index number (1890–1913), and Bradstreet's index (1890–1913). See the Bureau's *Bulletins No. 173*, p. 108, and *No. 181*, p. 19. I do not use the Bureau's own unweighted series of this type, because it is not computed in the proper way. Compare the explanation of method, p. 17 of *Bulletin No. 181*, with the criticism on pp. 39–42 of *Bulletin No. 173*.

[4] See *Bulletin No. 173*, p. 98. The corresponding figure for the Bureau's new weighted index is 4.0 per cent (*Bulletin No. 181*, p. 16).

Granted the greater variability of stock indexes in this sense, however, it cannot be said that the differences of variability among them (once more omitting Nos. 4 and 11) are wider in proportion to their magnitude than the corresponding differences among the commodity indexes.

3. Long-period comparisons give a result less favorable to the consistency of stock indexes. Net changes between 1890 and 1915, reckoned on the 1890–99 base, are made out to be zero by one series (Table III, No. 1), while another series (No. 8) shows a rise of 106 per cent. Eight commodity indexes in this case all concur in showing that prices rose between 1890 and 1913, and they make this rise come within the moderate limits of 17–35 per cent.[1] This marked contrast between the comparative harmony of commodity indexes and the wide divergences of stock indexes over considerable periods of time is doubtless due in part to the fundamental difference between the two classes of goods pointed out in Section I.

4. Averages of the yearly differences among the several indexes make closer comparison possible, but require a more elaborate scheme of presentation. This is provided by Tables IV and V, based respectively upon Tables II and III. In both tables, corresponding figures concerning commodity indexes are added for comparison.

In the series on the preceding-year base (Table IV) three cases of agreement appear among stock indexes (Nos. 6 and 7, 5 and 7, 5 and 6) closer than any pair of commodity indexes can show. Further, there are three other cases of agreement between two stock series closer than that between the most divergent pair of commodity indexes (Nos. 2 and 3, 1 and 5, 6 and 9). But on the other hand most of the forty-five comparisons (each of which is entered twice in the table) show differences much wider than any found between commodity series. Even if we drop once more the most erratic couple of stock indexes (Nos. 4 and 10) we find that the remaining eight differ among themselves by margins that average almost twice as wide as those among the commodity series.

[1] *Bulletin No. 173*, p. 98. The corresponding figure for the Bureau's new weighted index is 26 per cent (*Bulletin No. 181*, p. 16).

TABLE IV

AVERAGE DIFFERENCES AMONG TEN INDEX NUMBERS OF STOCKS AND AMONG FOUR INDEX NUMBERS OF COMMODITIES: PERCENTAGES OF RISE OR FALL FROM ONE YEAR TO THE NEXT

(Based upon Table II above, and upon *Bulletin of the U.S. Bureau of Labor Statistics, No. 173*, p. 108; and *No. 181*, p. 19)

(The figures in each space of the table show the average number of points in the scale of relative prices on the preceding-year base between the yearly entries of the two index numbers which are indicated by the descriptive title above and by the numeral in the left-hand margin)

1. TEN STOCK INDEXES, 1890–1915

NUMERALS DESIGNATING THE SEVERAL INDEX NUMBERS	FORTY TRANSPORTATION STOCKS								TWENTY RAILWAY STOCKS; *Wall Street Journal* SERIES FROM TABLE I	ALL STOCKS SOLD ON THE NEW YORK STOCK EXCHANGE FROM TABLE I
	Series Made from the Percentages of Rise or Fall in the Average Yearly Prices of Each Stock		Series Made from the Average Actual Prices Shown in Table I							
			Simple Averages			Weighted Averages				
						Arithmetic Means Weighted by				
	Medians (1)	Arithmetic Means (2)	Geometric Means (3)	Medians (4)	Arithmetic Means (5)	Stock Outstanding (6)	Earnings (7)	Number of Shares Sold (8)	(9)	(10)
(1)	.....	4.3	3.1	8.5	2.6	3.1	3.3	5.3	3.8	9.7
(2)	4.3	.....	2.3	7.1	5.7	6.6	6.6	5.7	6.3	12.9
(3)	3.1	2.3	.....	7.8	4.8	5.7	5.6	5.3	6.0	11.9
(4)	8.5	7.1	7.8	.....	9.6	10.2	10.4	8.1	9.8	16.2
(5)	2.6	5.7	4.8	9.6	.....	1.3	1.2	4.9	3.1	8.1
(6)	3.1	6.6	5.7	10.2	1.3	.....	0.6	5.1	2.7	7.3
(7)	3.3	6.6	5.6	10.4	1.2	0.6	.....	5.2	4.4	7.4
(8)	5.3	5.7	5.3	8.1	4.9	5.1	5.2	.....	4.6	10.6
(9)	3.8	6.3	6.0	9.8	3.1	2.7	4.4	4.6	.....	7.7
(10)	9.7	12.9	11.9	16.2	8.1	7.3	7.4	10.6	7.7	.....
Averages	4.9	6.4	5.8	9.7	4.6	4.7	5.0	6.1	5.4	10.2
Averages excluding Nos. 4 and 10	3.6	5.4	4.7	.....	3.4	3.6	3.8	5.2	4.4	.....

TABLE IV—*Continued*

2. FOUR COMMODITY INDEXES, 1890–1914

Numerals Designating the Several Index Numbers	Bureau of Labor Statistics		Bradstreet's Index Number Reduced to Percentages of Yearly Rise or Fall	Dun's Index Number Reduced to Percentages of Yearly Rise or Fall
	Percentages of Yearly Rise or Fall in the Weighted Aggregates of Actual Prices (1)	Series Made from Arithmetic Means of Percentages of Yearly Rise or Fall (2)	(3)	(4)
(1)	.....	1.9	2.4	2.0
(2)	1.9	.....	1.9	2.9
(3)	2.4	1.9	.....	2.8
(4)	2.0	2.9	2.8	.....
Averages	2.1	2.2	2.4	2.6

On passing to the 1890–99 base, we get more commodity series for comparison, among them five pairs (Nos. 2 and 3, 1 and 5, 2 and 4, 3 and 4, 3 and 5) that agree a little more closely than the most similar pair of stock indexes (Nos. 6 and 7, average difference 2.1 points). Still there remain five pairs of the latter (Nos. 6 and 7, 5 and 7, 5 and 6, 5 and 10, 7 and 10) that agree as well or better with each other than do some pairs of the commodity indexes. The important thing to notice here, however, is that the 1890–99 base gives much more divergent results than the preceding-year base. Especially noteworthy is the fact that the fixed-base series tend to scatter more and more with the lapse of time, whereas the moving-base series show no such tendency. Table VI establishes this result. Percentages of change from prices in the year before do indeed scatter more in years of rising than in years of falling prices, but these divergences are not cumulative.

Since the stock indexes run upon a higher level than the commodity indexes in most years since 1890, they may be expected to show wider divergences than the commodity indexes. A supplementary computation is necessary to prove that these divergences are greater not only absolutely but also relatively. To this end it suffices to select from each of our sets of index numbers some single series, and then to compute each year the percentages by which it differs from each of its fellow-series. Table VII presents the results of this experiment. The series chosen as the standards

TABLE V

AVERAGE DIFFERENCES AMONG ELEVEN INDEX NUMBERS OF STOCKS AND AMONG EIGHT INDEX NUMBERS OF COMMODITIES: RELATIVE PRICES ON THE 1890–99 BASE

(Based upon Table III above and upon *Bulletin of the U.S. Bureau of Labor Statistics, No. 173*, pp. 96, 105, and *No. 181*, p. 16)

(The figures in each space of the table show the average number of points in the scale of relative prices on the 1890–99 base between the yearly entries of the two index numbers which are indicated by the descriptive title above and by the numeral on the left-hand margin)

I. ELEVEN STOCK INDEXES, 1890–1915

Numerals Designating the Several Index Numbers	Forty Common Stocks								Fifty Stocks: 40 Common and 10 Preferred; Arithmetic Means of Relative Prices	Twenty Railway Stocks; *Wall Street Journal* Series	All Stocks Sold on the New York Stock Exchange
	Series Made from the Relative Prices of Each Stock		Series Made from the Average Actual Prices Shown in Table I								
			Simple Averages			Weighted Averages					
						Arithmetic Means Weighted by					
	Medians (1)	Arithmetic Means (2)	Geometric Means (3)	Medians (4)	Arithmetic Means (5)	Stock Outstanding (6)	Earnings (7)	Number of Shares Sold (8)	(9)	(10)	(11)
(1)	.....	26	11	52	14	19	18	44	17	17	39
(2)	26	.....	16	27	28	35	34	21	10	29	59
(3)	11	16	.....	43	16	22	20	35	8	18	45
(4)	52	27	43	.....	54	61	60	17	36	54	85
(5)	14	28	16	54	.....	7	6	46	19	6	31
(6)	19	35	22	61	7	.....	2	53	26	8	24
(7)	18	34	20	60	6	2	.....	52	24	7	26
(8)	44	21	35	17	46	53	52	.....	29	47	77
(9)	17	10	8	36	19	26	24	29	.....	19	49
(10)	17	29	18	54	6	8	7	47	19	.....	31
(11)	39	59	45	85	31	24	26	77	49	31	.....
Averages	26	29	23	49	23	26	25	42	24	24	47
Averages excluding Nos. 4 and 11	21	25	18	.....	18	22	20	41	19	19	.....

TABLE V—*Continued*

2. EIGHT COMMODITY INDEXES, 1890–1913

Numerals Designating the Several Index Numbers	Bureau of Labor Statistics Series			Bradstreet's Index Number Shifted to the 1890–99 Base; 96 Commodities	Gibson's Index Number, Original List; 50 Commodities	Dun's Index Number Shifted to the 1890–99 Base; 310 (?) Commodities	Gibson's Present Index Number Shifted to the 1890–99 Base; 22 Commodities	*Annalist* Index Number with Missing Entries Supplied; 25 Commodities
	Relatives Made from Weighted Aggregates of Actual Prices (1)	Arithmetic Means of Relative Prices of 242 Commodities (2)	Arithmetic Means of Relative Prices of 145 Commodities (3)	(4)	(5)	(6)	(7)	(8)
(1)	.....	2.8	2.7	3.9	1.5	3.9	5.5	5.3
(2)	2.8	.....	1.0	1.9	2.5	5.5	7.2	6.6
(3)	2.7	1.0	.....	2.0	2.0	5.3	6.8	6.3
(4)	3.9	1.9	2.0	.....	3.5	6.6	7.0	6.7
(5)	1.5	2.5	2.0	3.5	.....	4.1	5.9	5.5
(6)	3.9	5.5	5.3	6.6	4.1	.....	4.5	6.1
(7)	5.5	7.2	6.8	7.0	5.9	4.5	.....	3.9
(8)	5.3	6.6	6.3	6.7	5.5	6.1	3.9	.....
Averages	3.7	3.9	3.7	4.5	3.6	5.1	5.8	5.8

for stock indexes are the simple arithmetic means of the actual prices of forty stocks and the two sets of relatives made from them (No. 3 in Table I, No. 5 in Tables II and III). For commodities the Bureau's new weighted average is used. This form of comparison does indeed diminish the differences among the stock indexes more than it diminishes the differences among the commodity indexes, and therefore it diminishes the differences between the two sets of differences. It gives us again cases in which two index numbers of stock prices agree with each other better than do certain index numbers of commodity indexes. Nevertheless, it still leaves the stock series considered as one group much less harmonious than the commodity series considered as a second group.

TABLE VI

AVERAGE DIFFERENCES AMONG VARIOUS INDEX NUMBERS OF STOCKS, BY PERIODS OF YEARS

(Based upon the data used in making Tables IV and V)

	SERIES COMPUTED UPON THE PRECEDING-YEAR BASE		SERIES COMPUTED UPON THE 1890–99 BASE	
	All Series in Table II	All Series except Nos. 4 and 10	All Series in Table III	All Series except Nos. 4 and 11
1890–1899	7.8	4.3	8.6	5.2
1900–1909	5.7	4.5	41.1	28.6
1910–1915	4.3	3.5	49.1	40.6
1890–1915	6.3	4.3	30.4	22.4

So far our comparisons of index numbers of the prices of stocks and of commodities indicate (1) that the stock indexes agree rather better than the commodity indexes concerning the direction in which prices move from one year to the next; (2) that they show these fluctuations to be of much greater amplitude in the case of stocks than in the case of commodities; (3) that in measuring the amplitude of these fluctuations over long periods of time they differ from one another much more than do commodity indexes, and (4) that when the entries for each successive year are compared the stock indexes continue to show wider discrepancies, not only absolutely but also relatively, than commodity indexes show.

TABLE VII

AVERAGE YEARLY DIFFERENCES BETWEEN CERTAIN INDEX NUMBERS OF STOCKS AND OF COMMODITIES IN PERCENTAGES OF THE SEVERAL SERIES SELECTED AS STANDARDS

STOCKS				COMMODITIES		
Series with Which Comparisons Are Made	Actual Prices, Table I; Differences Between Series 3 and the Series Named	Relative Prices on Preceding-Year Base, Table II; Differences between Series 5 and the Series Named	Relative Prices on 1890–99 Base, Table III; Differences between Series 5 and the Series Named	Series with Which Comparisons Are Made	Relative Prices on Preceding-Year Base; Differences between B.L.S. Weighted Series and the Series Named	Relative Prices on 1890–99 Base; Differences between the B.L.S. Weighted Series and the Series Named.
	Per Cent	Per Cent	Per Cent		Per Cent	Per Cent
Medians of relative prices	.....	2.5	8.6	B.L.S. simple average	1.9	2.3
Arithmetic means of relative prices	.....	5.1	16.8	B.L.S. revised, 145 commodities	.....	2.4
Geometric means of actual prices	33.8	4.6	9.9	Bradstreet's index number	2.4	3.4
Medians of actual prices	27.2	9.5	33.6	Gibson's index—original list	.....	1.5
Arithmetic means weighted by stock outstanding	11.1	1.3	4.0	Dun's index number	1.9	3.3
Arithmetic means weighted by earnings	23.2	1.0	3.2	Gibson's present index number	.....	4.9
Arithmetic means weighted by number of shares sold	16.8	4.7	27.7	*Annalist* index number	.....	5.0
Forty common and ten preferred stocks	.....	.....	11.2			
Wall Street Journal series of twenty railway stocks	12.9	3.1	3.9			
All stocks sold on the New York Exchange	16.2	8.1	18.6			

How disconcerting should these results be rated? Do they mean that the attempt to measure fluctuations in the prices of stocks had better be abandoned as fruitless? Or that the present stock indexes at least are untrustworthy? Or that some of the series are sound and the others misleading? If there is a choice, which series is most accurate?

To answer these questions, we must trace the discrepancies among these series back to their sources in different methods of construction and in the peculiarities of the data to which these methods are applied.

V. TECHNICAL DIFFERENCES OF CONSTRUCTION AND THEIR EFFECTS UPON THE RESULTS

Aside from the purely formal differences between averages of actual prices and these same averages reduced to relatives,[1] the stock index numbers before us differ technically in respect to: (1) the stocks included, (2) the kind of average struck, (3) weighting, (4) the use of averages of relative prices or relatives of average prices, and (5) the base on which relative prices are computed.[2] In certain cases two or three series are alike in all save one of these five respects; in most cases they differ in two or more respects.

To trace out the differences in results produced by all of these differences of method in all of their combinations would be tedious.

[1] That is, the differences between the series in Table I and the corresponding series in Table II, columns 3–10, and Table III, columns 3–8, 10 and 11.

[2] More in detail: (1) Four different samples of stocks are used: (*a*) common stocks in forty transportation companies, (*b*) these forty stocks with ten preferred railway stocks added, (*c*) the *Wall Street Journal's* changing list of twenty railway stocks, common and preferred, (*d*) the *Financial Review's* figures for all stocks sold each year on the New York Exchange. (2) Three kinds of average are employed, arithmetic means, geometric means, and medians. (3) Both haphazard and systematic weights are tried. In the "simple" averages the relative influence exercised upon the results by each stock is left to chance, and cannot be determined without a special inquiry (see Section X, below). Four sets of systematic weights are employed—three sets that remain constant throughout the whole period and one set that changes every year (in the series from the *Financial Review*). (4) In some series the actual prices of each stock are turned into relative prices at the outset and then these relatives are averaged. In other series the actual prices are first averaged and then the averages are turned into relatives. (5) In both of the procedures just described, the relatives are worked out on two different bases—one changing every year, the other fixed.

But the self-explanatory schedules which follow provide data for a few significant conclusions.

Series in Table II Which Differ *Only* in Respect to:	Average Differences in Results
1. Sampling	
Nos. 5 and 9–40 stocks vs. 20 stocks	3.1 points
2. Forms of average used	
Averages of relative prices	
Nos. 1 and 2—Medians vs. arithmetic means	4.3
Nos. 1 and 3—Medians vs. geometric means[1]	3.1
Nos. 2 and 3—Arithmetic vs. geometric means	2.3
Relatives of average actual prices	
Nos. 3 and 4—Geometric means vs. medians	7.8
Nos. 3 and 5—Geometric vs. arithmetic means	4.8
Nos. 4 and 5—Medians vs. arithmetic means	9.6
3. Weighting	
Nos. 6 and 7—Stocks outstanding vs. earnings as weights	0.6
Nos. 6 and 8—Stock outstanding vs. shares sold as weights	5.1
Nos. 7 and 8—Earnings vs. shares sold as weights	5.2
4. Use of averages of relative prices vs. relatives of average actual prices:	
Nos. 1 and 4—Medians	8.5
Nos. 2 and 5—Arithmetic means	5.7

Series in Table III Which Differ *Only* in Respect to:	Average Differences in Results
1. Sampling	
Nos. 5 and 10—40 stocks vs. 20 stocks	6 points
Nos. 2 and 9—40 stocks vs. 50 stocks	10
2. Forms of average used	
Averages of relative prices	
Nos. 1 and 2—Medians vs. arithmetic means	26
Nos. 1 and 3—Medians vs. geometric means	11
Nos. 2 and 3—Arithmetic vs. geometric means	16
Relatives of average actual prices	
Nos. 3 and 4—Geometric means vs. medians	43
Nos. 3 and 5—Geometric vs. arithmetic means	16
Nos. 4 and 5—Medians vs. arithmetic means	54

[1] The geometric means in Tables II and III were actually computed from geometric means of actual prices. But when this form of average is used, it makes no difference whether relative prices are made first and then averaged, or whether actual prices are first averaged and then reduced to relatives. Hence in these two schedules, the geometric means are fairly included under both captions, "Averages of relative prices" and "Relatives of average actual prices."

3. Weighting
   - Nos. 6 and 7—Stock outstanding vs. earnings as weights..... 2
   - Nos. 6 and 8—Stock outstanding vs. shares sold as weights... 53
   - Nos. 7 and 8—Earnings vs. shares sold as weights..... 52

4. Use of averages of relative prices vs. relatives of average prices
   - Nos. 1 and 4—Medians..... 52
   - Nos. 2 and 5—Arithmetic means..... 28

Among these differences in method it will be seen that differences of sampling produce on the whole the slightest differences in results. The form of average used counts for more, especially when the averages are struck from the actual prices. Whether weighting makes very little or very great differences depends on whether the weights themselves differ slightly or widely. Stock outstanding and earnings give weights that are much the same, while the number of shares sold yields a radically different set (see Table XXI, below). When the same sample, the same form of average, and no systematic weights are used, it also makes a great difference in the results whether relatives are made first and then averaged or averages are made first and then turned into relatives.

As for the fifth difference noted at the beginning of this section, that in the base on which relatives are computed, it affects only the series that are made by averaging relative prices—that is, Nos. 1 and 2 in Table II, and Nos. 1, 2, and 9 in Table III. To determine its effect upon the results requires a new computation. Percentages of annual rise or fall in price may be made from the 1890–99 relatives of Table III and set beside the year-to-year relatives of Table II. When this is done the new figures based on column 1 of Table III (medians) show average differences of 4.7 points from the corresponding series in Table II. In the case of the arithmetic means (column 2 in both tables) the average differences in results are less—2.4 points. It may be pointed out further that this difference in the base used often alters the relationship in results among the several series. To give but one example: On the preceding-year base the medians of relative prices differ least in results from the relatives made from arithmetic means of actual prices (Table II, Nos. 1 and 5); whereas on the 1890–99 base these medians differ least in results from the geometric means (Table III, Nos. 1 and 3).

One wider generalization may be stated. In a majority of cases the series that resemble each other most closely in point of construction are not the series that resemble each other most closely in point of results.[1]

In these relations between methods and results, we have another difference between index numbers of stocks and commodities. Much the most important factor in producing differences among the results of commodity index numbers is sampling. That is, differences in the commodities included count for much more than any other difference in construction.[2] If we may judge from the present material, however, when one deals with stocks, differences in sampling count for less than differences in averaging, in weighting, or in the stage at which actual prices are turned into relatives. And more than half of the indexes find their closest analogues in series to which they are not closely related in construction.

These conclusions seem puzzling. The relatively moderate difference produced by using twenty common and preferred stocks in place of forty common stocks, or by adding ten preferred stocks to forty common, suggests that the three available samples must

[1] Again the facts may be presented succinctly in schedule form:

Table II Series	Differs Least in		Table III Series	Differs Least in	
	Construction from	Results from		Construction from	Results from
No. 1.....	Nos. 2, 3	No. 5	No. 1.....	Nos. 2, 3	No. 3*
" 2.....	" 1, 3	" 3*	" 2.....	" 1, 3, 9	" 9*
" 3.....	" 1, 2	" 2*	" 3.....	" 1, 2, 4, 5	" 9
" 4.....	" 3, 5	" 2	" 4.....	" 3, 5	" 8
" 5.....	" 3, 4, 9	" 7	" 5.....	" 3, 4	Nos. 7, 10
" 6.....	" 7, 8	" 7*	" 6.....	" 7, 8	No. 7*
" 7.....	" 6, 8	" 6*	" 7.....	" 6, 8	" 6*
" 8.....	" 6, 7	" 9	" 8.....	" 6, 7	" 4
" 9.....	No. 5	" 6	" 9.....	No. 2	" 3
" 10.....	" 8	" 6	" 10.....	" 5	" 5*
			" 11.....	" 8	" 6

Nine of the series (marked by asterisks) agree best in results with some one of the series to which they are most closely related in construction; but twelve series agree better with some stranger, than with their next of kin. And of the first nine cases, four hardly count, because the differences in the weights based upon stock outstanding and upon earnings (Nos. 6 and 7 in both tables) are so slight as not to constitute an important difference in method.

[2] See the comparison of seven commodity index numbers for the United States, 1890–1913, in *Bulletin of the Bureau of Labor, No. 173*, pp. 93–106, especially pp. 103–5.

be rather similar.[1] That would be reassuring. But the wider differences produced by working up the same sample in various ways suggest that a given sample must contain within itself most dissimilar elements. And that would be disconcerting. Is the explanation perhaps that the different samples are alike only in that none of them are composed of homogeneous data? If that is the case, can we make any series from any sample that possesses high representative value? These questions force us to push our inquiry home by scrutinizing the original data from which our stock indexes are made.

VI. CHARACTERISTICS AND DIFFICULTIES OF THE DATA FROM WHICH STOCK INDEXES ARE MADE

To present in full the original data used in making even one set of the stock index numbers presented above—the set including forty common stocks—would fill many pages and give no clear impression. For these data consist of some 24,000 quotations from the Stock Exchange lists, showing monthly for twenty-six years the highest and lowest prices of each stock.[2] To reduce the bulk of material and still to keep its essential character, the twenty-four quotations for each stock each year have been made into a single arithmetic mean. But even that step leaves 1,040 prices to deal with—a bewildering number when one tries to see the whole array at once. To bring the data within manageable compass there is needed a series of systematic presentations each of which comprises all the material, while throwing some significant feature into relief.

Tables VIII, IX, and X treat the individual stocks, showing respectively their actual prices, percentages of change in price from one year to the next, and relative prices on the 1890–99 base.

[1] The fourth sample—all stocks sold on the New York Stock Exchange—is not included in the analysis, because the series in which it is used (No. 10 in Table II, No. 11 in Table III) differs from all the others not only in sampling, but also in weighting, and we have no means of separating the effects of these two differentiating characteristics.

[2] If no quotations were missing, there would be 24,960 prices. But in 1914 the Stock Exchange was closed from August to November, and in every other year one or more stocks failed to be quoted in one or more months. In recent years, however, these gaps have been filled by bid and asked prices, or by interpolations.

TABLE VIII

AVERAGE AND EXTREME PRICES OF FORTY COMMON STOCKS IN 1890–1915. ARITHMETIC MEANS

	AVERAGE PRICES IN				EXTREME PRICES IN 1890–1915		YEARS IN WHICH EXTREME YEARLY AVERAGE PRICES OCCURRED	
	1890–1915 (1)	1890–1899 (2)	1900–1909 (3)	1910–1915 (4)	Highest Yearly Average (5)	Lowest Yearly Average (6)	Highest (7)	Lowest (8)
Forty stocks—average	$ 80.69	$ 54.80	$ 97.92	$ 95.12	$120.10	$ 46.36	1909	1896
North Atlantic railways—average	94.17	91.96	105.65	78.72	122.58	60.38	1902	1914
New York, New Haven & Hartford	178.82	207.92	191.16	109.77	256.20	60.80	1890	1914
New York, Ontario & Western	28.71	17.54	37.01	33.48	52.50	14.20	1905	1896
New York Central	116.24	107.42	133.32	102.55	159.30	85.30	1902	1914
Pennsylvania	121.24	109.37	134.85	118.40	155.10	100.20	1902	1894
Erie	25.82	17.56	31.93	29.40	45.90	10.80	1905	1895
Anthracite coal railways—average	180.51	104.00	200.85	274.19	313.13	92.20	1912	1898
Central Railroad of New Jersey	181.13	108.33	179.06	305.98	367.80	89.10	1912	1897
Delaware & Hudson	151.52	126.68	171.89	159.02	215.90	107.00	1906	1898
Delaware, Lackawanna & Western	310.63	154.45	367.83	475.73	589.60	137.50	1909	1891
Reading	78.76	26.54	84.60	156.03	166.20	14.80	1912	1895
Middle-western railways—average	48.13	35.60	59.68	49.75	74.71	29.05	1902	1896
Cleveland, Cincinnati, Chicago & St. Louis	61.00	47.97	80.68	49.95	102.00	29.60	1902	1914
Wheeling & Lake Erie	13.26	16.50	15.14	4.75	35.10	1.90	1890	1897
New York, Chicago & St. Louis	33.14	14.80	41.05	50.53	66.10	12.60	1906	1896
Wabash	12.26	8.77	18.67	7.40	28.40	.60	1902	1915
Pittsburgh, Cincinnati, Chicago & St. Louis	59.29	24.89	75.50	89.60	106.90	13.10	1912	1890
Canada Southern	60.42	52.69	67.24	61.92	87.60	47.70	1902	1896
Lake Erie & Western	23.14	18.35	34.72	11.83	63.10	6.00	1902	1914
Illinois Central	122.50	100.83	144.45	122.05	174.30	91.80	1906	1894
Northwestern railways—average	65.28	41.43	88.42	66.48	109.20	32.81	1902	1894
Chicago, Milwaukee & St. Paul	114.05	79.20	152.62	107.85	178.20	60.50	1905	1894
Chicago & Northwestern	147.50	114.66	186.84	136.75	234.00	99.20	1902	1895
Chicago, St. Paul, Minneapolis & Omaha	107.12	51.39	148.41	131.22	189.70	28.70	1905	1891

Chicago, Milwaukee & St. Paul	114.05	79.20	152.62	107.85	178.20	60.50	1905	1894
Chicago & Northwestern	147.50	114.66	186.84	136.75	234.00	99.20	1902	1895
Chicago, St. Paul, Minneapolis & Omaha	107.12	51.39	148.41	131.22	189.70	28.70	1905	1891
Duluth, South Shore & Atlantic	9.06	5.86	12.72	8.30	18.90	2.90	1906	1898
Iowa Central	16.77	9.20	27.21	11.98	45.40	6.40	1902	1914
Minneapolis & St. Louis	38.14	19.58	66.75	21.40	110.60	5.80	1902	1891
Wisconsin Central	24.30	10.11	24.37	47.83	61.50	2.00	1911	1898
Southern railways—average	49.62	27.09	63.04	64.80	76.85	18.40	1906	1896
Chesapeake & Ohio	41.16	20.81	46.44	66.30	80.30	15.50	1910	1896
Norfolk & Western	55.47	12.10	68.91	105.33	113.40	3.60	1912	1895
Louisville & Nashville	102.01	62.79	119.09	138.88	156.50	47.40	1912	1896
Missouri Pacific	56.34	41.42	84.64	34.03	106.90	8.40	1902	1915
Missouri, Kansas & Texas	21.35	13.08	28.02	24.00	43.20	7.70	1909	1890
Texas & Pacific	21.38	12.31	31.13	20.27	43.10	7.80	1902	1893
Pacific railways—average	74.26	33.29	89.12	117.75	132.98	21.96	1912	1896
Atchison, Topeka & Santa Fe	62.57	21.63	79.81	102.07	113.10	8.60	1909	1894
Denver & Rio Grande	23.31	14.91	33.70	20.00	47.40	8.10	1909	1915
Southern Pacific	60.96	26.22	70.33	103.22	126.20	17.30	1909	1897
Union Pacific	93.74	29.29	120.79	156.07	193.00	7.60	1909	1896
Canadian Pacific	130.70	74.41	140.96	207.40	256.70	52.30	1912	1895
Express companies, etc.—average	104.74	82.48	133.02	94.70	163.94	66.90	1909	1914
American Express	165.39	119.19	207.74	171.87	259.50	97.30	1910	1915
United States Express	76.52	51.66	100.14	78.55	124.50	41.20	1902	1896
Wells Fargo	168.67	124.21	239.03	125.57	389.40	85.00	1909	1914
Pacific Mail Steamship	31.51	30.41	35.35	26.93	46.70	17.00	1899	1894
Western Union	81.60	86.94	82.84	70.58	93.40	56.90	1905	1908

Years in Which Maximum Prices Occurred, and Number of Stocks Showing Maximum Prices in Those Years		Years in Which Minimum Prices Occurred, and Number of Stocks Showing Minimum Prices in Those Years	
1890	2	1890	2
1899	1	1891	3
1902	12	1893	1
1905	5	1894	5
1906	4	1895	5
1909	7	1896	7
1910	2	1897	3
1911	1	1898	3
1912	6	1908	1
		1914	6
		1915	4
	40		40

TABLE IX

CHANGES IN THE PRICES OF FORTY COMMON STOCKS FROM ONE YEAR TO THE NEXT: 1890–91 TO 1914–15

ARITHMETIC MEANS

	Number of Years in Which Average Annual Prices			Average Percentage of Change in Prices from One Year to the Next			Extreme Percentages of Change	
	Rose (1)	Fell (2)	Did Not Change (3)	All Cases (4)	Cases of Rise (5)	Cases of Fall (6)	Greatest Rise (7)	Greatest Fall (8)
				Per Cent	Per Cent	Per Cent	Per Cent	Per Cent
Forty stocks—average	12	13	.....	20.1	26.9	14.8	61.7	23.8
North Atlantic railways—average	11	14	.....	13.8	17.4	11.0	53.8	24.5
New York, New Haven & Hartford	10	15	.....	9.8	6.6	11.9	17.6	40.3
New York, Ontario & Western	11	14	.....	18.2	25.7	12.3	78.6	26.6
New York Central	11	14	.....	10.0	11.6	8.8	26.4	20.3
Pennsylvania	12	12	1	6.1	6.8	5.9	14.7	16.4
Erie	11	14	.....	25.1	36.3	16.3	193.0	45.7
Anthracite coal railways—average	13	12	.....	16.2	21.4	10.4	54.1	21.3
Central Railroad of New Jersey	14	11	.....	16.8	20.9	11.6	108.2	36.4
Delaware & Hudson	11	14	.....	8.7	10.5	7.2	42.6	21.3
Delaware, Lackawanna & Western	13	12	.....	11.2	16.1	6.0	44.3	26.4
Reading	13	12	.....	28.0	38.2	16.9	121.3	57.3
Middle-western railways—average	11	14	.....	22.0	29.7	16.9	78.4	31.0
Cleveland, Cincinnati, Chicago & St. Louis	12	13	.....	18.8	19.4	18.2	54.0	36.7
Wheeling & Lake Erie	9	16	.....	39.9	61.0	28.1	285.7	78.4
New York, Chicago & St. Louis	12	11	2	23.2	33.4	16.3	170.3	44.0
Wabash	9	16	.....	28.2	34.5	24.6	157.7	59.7
Pittsburgh, Cincinnati, Chicago & St. Louis	14	11	.....	23.2	30.4	14.1	129.4	30.2
Canada Southern	11	14	.....	7.7	9.7	6.2	36.5	23.3
Lake Erie & Western	9	15	1	27.2	41.8	20.2	106.9	45.0
Illinois Central	13	12	.....	7.6	7.7	7.6	23.5	19.6
Northwestern railways—average	12	13	.....	25.9	36.3	17.7	114.5	33.6
Chicago, Milwaukee & St. Paul	11	14	.....	12.6	16.9	9.2	35.8	28.4

Lake Erie & Western	9	15	1	27.2	41.8	20.2	106.9	45.0
Illinois Central	13	12	.....	7.6	7.7	7.6	23.5	19.6
Northwestern railways—average	12	13	.....	Per Cent 25.9	Per Cent 36.3	Per Cent 17.7	Per Cent 114.5	Per Cent 33.6
Chicago, Milwaukee & St. Paul	11	14	.....	12.6	16.9	9.2	35.8	28.4
Chicago & Northwestern	12	12	1	10.3	12.3	9.0	24.1	29.1
Chicago, St. Paul, Minneapolis & Omaha	14	11	.....	16.6	21.8	10.0	72.1	26.2
Duluth, South Shore & Atlantic	11	14	.....	31.3	41.9	23.6	81.6	38.6
Iowa Central	15	10	.....	26.9	26.5	27.5	93.8	39.6
Minneapolis & St. Louis	12	13	.....	38.7	54.4	24.2	142.7	41.6
Wisconsin Central	10	15	.....	45.0	80.4	21.3	495.0	46.9
Southern railways—average	12	13	.....	22.4	29.4	16.6	79.4	26.0
Chesapeake & Ohio	13	12	.....	19.1	24.2	13.5	96.7	35.9
Norfolk & Western	15	10	.....	26.2	32.0	17.6	128.1	43.7
Louisville & Nashville	13	12	.....	13.2	15.2	11.0	34.2	23.4
Missouri Pacific	9	16	.....	24.0	28.2	21.7	90.8	51.5
Missouri, Kansas & Texas	11	14	.....	26.0	36.4	17.8	132.4	37.3
Texas & Pacific	9	16	.....	25.9	40.4	17.7	125.9	31.6
Pacific railways—average	12.5	12.5	.....	21.4	31.1	14.7	79.2	32.6
Atchison, Topeka & Santa Fe	14	11	.....	22.7	28.9	14.8	152.5	64.9
Denver & Rio Grande	7	17	1	27.4	53.8	18.1	114.3	49.7
Southern Pacific	15	10	.....	16.6	19.3	12.7	75.2	31.4
Union Pacific	12	13	.....	28.4	39.0	18.6	117.3	46.9
Canadian Pacific	14	11	.....	12.1	14.3	9.2	26.7	20.5
Express companies, etc.—average	12	13	.....	14.1	16.2	12.6	28.7	29.0
American Express	13	12	.....	10.5	10.3	10.6	25.5	30.3
United States Express	10	15	.....	16.6	23.0	12.4	50.9	41.5
Wells Fargo	13	12	.....	13.9	14.2	13.6	38.7	57.0
Pacific Mail steamship	12	13	.....	20.5	22.9	18.2	58.8	44.2
Western Union	11	14	.....	9.2	10.6	8.1	29.2	24.5

TABLE X

AVERAGE AND EXTREME RELATIVE PRICES OF FORTY COMMON STOCKS IN 1890–1915. AVERAGE ACTUAL PRICES IN 1890–99 = 100
ARITHMETIC MEANS

	AVERAGE RELATIVE PRICES IN				EXTREME RELATIVE PRICES IN 1890–1915		YEARS IN WHICH EXTREME YEARLY AVERAGE RELATIVE PRICES OCCURRED	
	1890–1915 (1)	1890–1899 (2)	1900–1909 (3)	1910–1915 (4)	Highest Yearly Average (5)	Lowest Yearly Average (6)	Highest (7)	Lowest (8)
Forty stocks—average	173	100	219	218	277	77	1909	1896
North Atlantic railways—average	123	100	146	123	186	86	1905	1896
New York, New Haven & Hartford	86	100	92	53	123	29	1890	1914
New York, Ontario & Western	164	100	211	191	300	81	1905	1896
New York Central	108	100	124	95	148	79	1902	1914
Pennsylvania	111	100	123	108	142	92	1902	1894
Erie	147	100	181	167	261	61	1905	1895
Anthracite coal railways—average	196	100	215	326	364	84	1912	1898
Central Railroad of New Jersey	167	100	165	282	340	82	1912	1897
Delaware & Hudson	120	100	136	126	170	84	1906	1898
Delaware, Lackawanna & Western	201	100	238	308	382	89	1909	1891
Reading	297	100	319	589	627	56	1912	1895
Middle-western railways—average	146	100	189	153	256	76	1902	1897
Cleveland, Cincinnati, Chicago & St. Louis	127	100	168	104	213	62	1902	1914
Wheeling & Lake Erie	80	100	92	29	213	12	1890	1897
New York, Chicago & St. Louis	224	100	277	341	447	85	1906	1896
Wabash	139	100	212	84	323	7	1902	1915
Pittsburgh, Cincinnati, Chicago & St. Louis	238	100	303	360	429	53	1912	1890
Canada Southern	115	100	128	117	166	91	1902	1896
Lake Erie & Western	126	100	190	65	345	33	1902	1914
Illinois Central	122	100	143	121	173	91	1906	1894
Northwestern railways—average	179	100	248	195	332	76	1902	1894
Chicago, Milwaukee & St. Paul	144	100	193	136	225	76	1905	1894
Chicago & Northwestern	130	100	162	110	204	86	1902	1895

Illinois Central	122	100	143	121	173	91	1906	1894
Northwestern railways—average	179	100	248	195	332	76	1902	1894
Chicago, Milwaukee & St. Paul	144	100	193	136	225	76	1905	1894
Chicago & Northwestern	129	100	163	119	204	86	1902	1895
Chicago, St. Paul, Minneapolis & Omaha	208	100	289	255	369	56	1905	1891
Duluth, South Shore & Atlantic	154	100	216	141	320	49	1906	1898
Iowa Central	182	100	296	130	493	70	1902	1914
Minneapolis & St. Louis	195	100	341	109	564	30	1902	1891
Wisconsin Central	241	100	241	474	609	20	1911	1898
Southern railways—average	215	100	276	307	358	67	1909	1896
Chesapeake & Ohio	198	100	223	319	386	75	1910	1896
Norfolk & Western	458	100	569	870	937	30	1912	1895
Louisville & Nashville	163	100	190	221	249	75	1912	1896
Missouri Pacific	136	100	204	82	258	20	1902	1915
Missouri, Kansas & Texas	163	100	214	183	330	59	1909	1890
Texas & Pacific	174	100	253	165	350	63	1902	1893
Pacific railways—average	235	100	293	363	445	64	1909	1896
Atchison, Topeka & Santa Fe	290	100	369	473	524	40	1909	1894
Denver & Rio Grande	156	100	226	134	318	54	1909	1915
Southern Pacific	233	100	268	394	482	66	1909	1897
Union Pacific	320	100	412	533	659	26	1909	1896
Canadian Pacific	176	100	189	279	345	70	1912	1895
Express companies, etc.—average	124	100	154	113	178	85	1906	1896
American Express	139	100	174	144	218	82	1910	1915
United States Express	148	100	194	152	241	80	1902	1896
Wells Fargo	136	100	192	101	314	68	1909	1914
Pacific Mail Steamship	104	100	116	89	154	56	1899	1894
Western Union	94	100	95	81	107	65	1905	1908

TABLE XI

DECILS OF THE ACTUAL PRICES OF FORTY COMMON STOCKS. BY YEARS: 1890–1915

Years	Lowest Price	First Decil	Second Decil	Third Decil	Fourth Decil	Median	Sixth Decil	Seventh Decil	Eighth Decil	Ninth Decil	Highest Price
1890	$ 6.00	$10.25	$17.25	$21.00	$31.20	$40.20	$68.35	$ 79.55	$ 107.95	$129.00	$256.20
1891	5.80	12.80	16.00	19.10	31.15	35.75	62.65	78.65	105.15	124.10	234.90
1892	10.00	12.15	17.00	23.70	31.90	45.50	59.45	84.25	111.55	133.95	240.90
1893	7.40	8.70	12.85	16.20	19.25	26.65	46.55	72.75	103.25	119.30	215.10
1894	5.30	7.75	9.90	14.60	16.10	19.60	43.75	63.15	99.60	115.40	185.70
1895	3.60	8.35	11.70	14.85	18.55	24.30	42.45	61.30	99.45	110.10	196.00
1896	2.60	7.10	10.25	14.20	15.30	20.15	40.50	65.30	94.90	108.05	172.80
1897	1.90	7.45	12.80	14.15	18.35	23.70	46.20	75.10	100.50	112.45	175.30
1898	2.00	8.30	13.20	15.20	21.45	32.05	48.40	87.55	106.80	124.15	189.80
1899	4.90	12.30	16.75	21.80	31.80	49.25	62.60	99.60	123.15	139.75	212.50
1900	5.10	11.95	17.45	25.35	35.55	52.15	60.85	103.25	123.00	143.85	212.10
1901	9.20	23.20	37.00	42.30	56.50	76.80	97.20	120.55	154.35	178.70	222.60
1902	16.60	27.90	42.85	49.60	65.25	91.70	108.75	139.55	166.30	221.00	273.30
1903	11.90	23.05	29.00	33.30	58.35	74.30	93.00	126.80	143.80	188.10	248.80
1904	8.70	20.25	28.20	31.45	55.70	71.50	94.30	122.75	148.90	185.65	283.60
1905	15.80	27.00	35.35	51.75	68.60	90.10	107.40	144.05	173.25	212.35	409.30
1906	18.30	27.75	37.60	53.70	74.30	93.20	129.60	155.30	177.95	219.65	504.40
1907	10.40	17.35	27.05	36.55	64.10	74.60	99.85	123.60	144.75	174.75	455.70
1908	8.20	17.40	24.30	34.30	53.55	72.35	97.75	126.35	144.25	176.60	511.90
1909	9.60	27.20	39.10	53.65	72.60	92.25	128.95	150.10	172.55	211.55	589.60
1910	5.30	19.40	30.95	47.60	67.70	98.20	117.80	139.80	153.35	181.45	551.60
1911	4.20	16.15	29.25	44.00	63.25	95.30	111.35	137.25	149.70	201.90	537.00
1912	5.80	13.25	25.90	38.60	62.25	96.45	111.95	132.55	148.25	186.05	549.10
1913	3.50	8.20	20.85	30.95	52.65	78.35	100.90	109.85	131.75	159.25	404.00
1914	1.20	6.20	14.05	23.95	43.10	65.35	87.05	100.20	127.65	148.70	389.50
1915	.60	8.00	11.20	28.80	41.55	67.90	91.15	104.20	120.20	149.40	423.20
Averages											
1890–1899	4.95	9.52	13.77	17.48	23.51	31.72	52.09	76.72	105.23	121.63	207.92
1900–1909	11.38	22.31	31.79	41.20	60.45	78.90	101.77	131.23	154.91	191.22	371.13
1910–1915	3.43	11.87	22.03	35.65	55.08	83.59	103.37	120.64	138.48	171.13	475.73
1890–1915	7.07	14.97	22.61	30.79	45.00	61.84	83.03	107.80	132.00	159.80	332.50

TABLE XII

DECILS OF THE PERCENTAGES OF RISE (+) OR FALL (−) IN THE PRICES OF FORTY COMMON STOCKS FROM ONE YEAR TO THE NEXT. BY YEARS: 1890–91 TO 1914–15

Years	Greatest Fall or Least Rise	First Decil	Second Decil	Third Decil	Fourth Decil	Median	Sixth Decil	Seventh Decil	Eighth Decil	Ninth Decil	Greatest Rise or Least Fall
1890–91	−27.80	−19.45	−10.20	− 7.90	− 6.25	− 3.30	− 2.15	− 1.40	− 0.10	+ 3.80	+ 96.10
1891–92	−25.70	−11.50	− 5.05	+ 2.55	+ 3.95	+ 6.90	+ 9.85	+14.55	+ 21.90	+ 56.60	+136.20
1892–93	−57.30	−42.25	−35.85	−30.80	−24.00	−16.75	−14.20	−11.60	− 7.85	− 5.30	+ 3.70
1893–94	−64.90	−31.20	−21.50	−16.25	−13.60	−10.85	− 8.60	− 3.90	− 1.10	+ 8.25	+ 16.70
1894–95	−43.70	−19.70	− 8.00	− 1.60	+ 2.30	+ 4.25	+ 5.60	+10.40	+ 13.05	+ 31.35	+142.70
1895–96	−46.90	−26.70	−18.65	−15.70	−13.05	−10.45	− 5.95	− 2.70	+ 1.85	+ 9.85	+ 58.30
1896–97	−78.40	−11.80	− 5.00	+ 0.75	+ 2.60	+ 6.15	+ 9.70	+13.35	+ 24.25	+ 44.25	+128.10
1897–98	−19.40	− 7.10	− 2.00	+ 3.00	+ 6.50	+ 9.65	+13.00	+14.40	+ 20.45	+ 31.70	+129.40
1898–99	− 0.30	+ 7.00	+10.35	+13.00	+19.15	+24.50	+37.05	+50.40	+ 60.10	+ 72.10	+495.00
1899–1900	−22.10	−12.45	− 7.90	− 5.95	− 2.05	+ 0.15	+ 2.05	+ 7.05	+ 10.30	+ 31.35	+ 57.70
1900–1901	+ 0.30	+12.80	+18.70	+24.90	+34.80	+43.30	+54.60	+78.60	+110.60	+142.45	+193.00
1901–2	− 1.80	+ 2.60	+ 5.10	+ 6.95	+10.45	+16.05	+21.50	+24.20	+ 30.85	+ 40.00	+ 80.40
1902–3	−45.00	−32.90	−26.40	−22.60	−19.60	−17.00	−14.75	−12.75	− 9.10	− 5.10	+ 1.60
1903–4	−26.90	−18.50	− 9.60	− 5.30	− 4.75	− 2.10	− 0.35	+ 2.05	+ 5.15	+ 9.80	+ 14.00
1904–5	−36.40	+ 5.15	+11.05	+16.30	+22.00	+24.25	+26.75	+32.85	+ 43.15	+ 60.35	+ 94.80
1905–6	−11.00	− 5.85	− 3.35	− 2.25	− 0.95	+ 3.40	+ 5.20	+ 9.70	+ 14.70	+ 27.25	+108.20
1906–7	−45.70	−41.40	−37.25	−31.35	−26.65	−22.35	−19.65	−18.00	− 12.50	− 6.50	+ 5.30
1907–8	−30.80	−18.75	−13.55	− 6.15	− 5.30	− 3.35	+ 1.50	+ 3.85	+ 6.15	+ 11.15	+ 25.30
1908–9	+ 8.20	+12.35	+16.90	+17.90	+26.30	+30.25	+35.00	+42.15	+ 49.20	+ 74.85	+143.20
1909–10	−57.00	−30.35	−18.35	−14.60	−10.55	− 7.00	− 5.90	− 0.85	+ 1.60	+ 6.25	+ 16.00
1910–11	−23.80	−21.80	−11.25	− 8.35	− 6.90	− 5.10	− 2.75	− 1.10	+ 1.30	+ 9.05	+ 21.90
1911–12	−59.70	−22.70	−12.30	−10.30	− 5.05	− 2.10	± 0	+ 2.40	+ 6.85	+ 11.85	+ 73.80
1912–13	−41.50	−35.70	−29.40	−24.80	−19.80	−17.15	−13.55	−11.30	− 9.10	− 7.15	− 2.00
1913–14	−65.70	−38.80	−31.70	−25.15	−19.75	−14.20	−10.45	− 5.85	− 4.70	− 2.65	+ 39.00
1914–15	−50.00	−21.25	− 7.60	− 3.60	− 2.05	− 0.35	+ 2.05	+ 8.05	+ 19.35	+ 23.00	+ 46.70
Averages											
1890–1900	−38.65	−17.52	−10.38	− 5.89	− 2.45	+ 1.03	+ 4.64	+ 9.06	+ 14.29	+ 28.40	+126.39
1900–1910	−24.61	−11.49	− 5.68	− 1.62	+ 2.58	+ 6.55	+10.39	+16.18	+ 23.98	+ 36.05	+ 68.18
1910–1915	−48.14	−28.05	−18.45	−14.44	−10.71	− 7.78	− 4.94	− 1.56	+ 2.74	+ 6.82	+ 35.88
1890–1915	−34.93	−17.21	−10.11	− 5.89	− 2.09	+ 1.47	+ 5.02	+ 9.78	+ 15.85	+ 27.14	+ 85.00

TABLE XIII

DECILS OF THE RELATIVE PRICES OF FORTY COMMON STOCKS, COMPUTED ON THE BASIS: AVERAGE ACTUAL PRICES IN 1890–99 = 100

Years	Lowest Relative Price	First Decil	Second Decil	Third Decil	Fourth Decil	Median	Sixth Decil	Seventh Decil	Eighth Decil	Ninth Decil	Highest Relative Price
1890	30	72	93.5	97.5	105	109.5	120.5	136	148.5	172.5	266
1891	30	84.5	94.5	98	102	108	114.5	120.5	132.5	153.5	210
1892	70	98	101.5	105	111	115	120	129	142	169.5	210
1893	61	66	85.5	89.5	93.5	95	96.5	99	102.5	107.5	147
1894	40	52.5	67.5	73.5	79	87.5	91	93	97	101	106
1895	30	54.5	71.5	82	87	89	92.5	94.5	99	104	121
1896	26	53.5	64	75	77	81.5	85	88.5	92	96	102
1897	12	59.5	71	81	85	88.5	90	96.5	98.5	103.5	127
1898	17	66	79.5	85.5	89	92.5	98.5	105.5	108.5	124.5	178
1899	65	87.5	98	104	109	117	123	138	150.5	173	303
1900	60	86	92	102	119	124.5	129	139	151	211	306
1901	102	127	137.5	147.5	160.5	188.5	203.5	235.5	287	332.5	488
1902	104	139.5	157.5	175	204	220	246.5	288.5	343.5	378.5	564
1903	94	119	132.5	158	168.5	183.5	196	205	253.5	298.5	535
1904	92	108.5	132.5	159.5	165	172	189	210.5	227	285.5	522
1905	97	131	163	194.5	215.5	240.5	254	268.5	313	385.5	689
1906	94	127	171.5	200.5	227	238	275.5	292	329	445.5	748
1907	63	95.5	123	140	167	179	195.5	224	257	348	610
1908	49	92	117	132.5	158	169.5	192	219	259	366.5	586
1909	58	118	139	166.5	193.5	249	286	323.5	376.5	517.5	761
1910	32	99.5	127.5	139.5	165.5	218.5	233.5	267.5	389	500	817
1911	25	91	118	129.5	160.5	188	225	261.5	381	535	878
1912	44	86.5	112	120.5	132.5	164.5	202.5	301	384.5	517.5	937
1913	33	62	82.5	95.5	113	125	163.5	250	334	461	870
1914	14	35.5	65.5	70.5	103.5	112	133.5	240	263	397.5	830
1915	7	39.5	73.5	83.5	94	109.5	141	223.5	276.5	392.5	890
Averages											
1890–1899	38.1	69.4	82.7	89.1	93.8	98.4	103.2	110.1	117.1	130.5	177.0
1900–1909	81.3	114.4	136.6	157.6	177.8	196.5	216.7	240.6	279.7	356.9	580.9
1910–1915	25.8	69.0	96.5	106.5	128.2	152.9	183.2	257.3	338.0	467.3	870.3
1890–1915	51.9	86.6	106.6	119.5	134.0	148.7	165.3	194.2	230.6	295.3	492.4

The only explanation needed concerning them is that the highest and lowest figures for the groups are not averages of the corresponding figures for single stocks, but the extreme figures found after the figures for single stocks have been averaged by years.[1] Tables XI, XII, and XIII correspond to the preceding set in showing respectively actual prices, ratios of change from one year to the next, and relative prices computed on a fixed base. They differ from Tables VIII–X in not giving the names of particular stocks, but in showing for each year the highest and lowest figures and the nine intervening decils (of which the fifth is the median)—that is, the points which divide into ten equal parts the forty entries for each year, after these entries have been arranged in order of magnitude from lowest to highest.[2]

At this point the reader should surrender himself to the fascination of these six tables for a time, and not return to the text until the questions which the figures suggest and do not answer begin to clamor for discussion.

With many of the facts regarding particular stocks which make these tables interesting to investors the maker of index numbers is little concerned. What does concern him deeply is the wide dispersion of stock prices and of their variations, whether these variations be counted in dollars and cents, in percentages of yearly rise and fall, or in relative prices made on a fixed base. For it is this wide dispersion that accounts for the divergences among different index numbers made from the same data, and that raises

[1] For example, Table VIII, column 5, shows that in the North Atlantic group one stock reached its highest yearly price in 1890, two stocks in 1902, and two in 1905. The average of these individual maximum prices would be $133.80. But when the yearly prices of the five stocks are treated as a group, the highest average price occurs in 1902, and that price is only $122.58—the entry in the table.

[2] Of these tables, the only one hitherto published even in part is Table XIII. The present version of this table differs from its predecessors (*Journal of Political Economy*, XVIII, 375; *Business Cycles*, p. 192) in one particular. Some statisticians decline to recognize as a true median the computed value which lies midmost between the two middle members of a series having an equal number of terms. Of course the same scruple applies in locating the decils. Hence I formerly adopted the arbitrary rule of not counting the highest figure in finding the decils—a rule which left thirty-nine entries and gave each decil a definite location. In the present case, however, I have counted in the full forty stocks, and accepted at their face value computed figures intermediate between two entries.

a serious doubt whether any of these index numbers possess much significance.

This difficulty is much more serious in dealing with stocks than in dealing with commodities. Table XIV summarizes the results

TABLE XIV

COMPARISON OF THE PERCENTAGE VARIATIONS IN THE PRICES OF STOCKS AND OF COMMODITIES AT WHOLESALE FROM ONE YEAR TO THE NEXT

Averages are Arithmetic Means

	Forty Common Stocks 1890–1915	Forty Selected Commodities 1890–1914	All Commodities Quoted by B.L.S. in 1890–1913
	Per Cent	Per Cent	Per Cent
Average change	20.1	13.0	8.6
Average change in cases of fall	14.8	11.6	8.8
Average change in cases of rise	26.9	14.4	10.9
Average net rise in period covered	4.4	2.0	1.4
Greatest rise of any item in any year	495.0	103.3	103.3
Greatest fall of any item in any year	78.4	54.6	54.6

of a comparison between the percentage variations in stock and commodity prices from one year to the next. Against data concerning stocks drawn from Tables IX and XII it sets similar figures for all commodities quoted by the Bureau of Labor Statistics in 1890–1913 and for forty commodities selected from the Bureau's list because of their exceptional variability in price.[1]

[1] The figures for all commodities quoted by the Bureau are taken from the data used in making Tables II and IV of *Bulletin No. 173*, pp. 15 and 19. The figures for forty selected commodities are from a new compilation based upon *Bulletin No. 181*, Table II. The commodities in question are the following:

1. Cotton, middling, New York
2. Corn, cash contract
3. Oats, cash
4. Wheat, cash, Chicago
5. Hides, green salted
6. Cattle, steers, good to choice
7. Hogs, heavy
8. Sheep, western
9. Butter, creamery, New York
10. Coffee, Rio
11. Eggs, New York
12. Fish, cod
13. Flour, wheat, standard
14. Meal, corn, yellow
15. Salt, American
16. Pepper
17. Sugar, 96° centrifugal
18. Onions
19. Potatoes, white
20. Silk, raw, Japanese
21. Wool, Ohio, medium
22. Coal, Georges Creek, at mine
23. Coke
24. Petroleum, crude
25. Copper, ingot
26. Lead, pig
27. Pig iron, foundry, No. 2
28. Steel billets
29. Tin, pig
30. Spelter
31. Brick
32. Cement, Rosendale 1890–99, domestic 1900–1914
33. Linseed oil, raw
34. Lumber, spruce
35. Rosin
36. Tar
37. Quinine
38. Jute
39. Paper, news
40. Rubber

More significant still for present purposes are the next two tables which put averages derived from the preceding tables of decils against averages derived from similar decils of the relative prices of commodities.[1] They represent the average annual range covered by the price fluctuations of stocks and commodities when these fluctuations are counted as percentages of prices in the preceding year (Table XV) and as percentages of prices in 1890–99 (Table XVI). In all four distributions there is a marked concentration toward the center of the field; that is, the inner tenths are packed into a much narrower range than the outer tenths. But this concentration is much less dense for stocks than for commodities; it is much more dense for both commodities and stocks when fluctuations are reckoned on the preceding-year base than when they are reckoned on the 1890–99 base; and the difference between the densities of concentration on these two bases is much wider for stocks than for commodities.

TABLE XV

AVERAGE ANNUAL DISPERSION OF THE RELATIVE PRICES OF STOCKS AND COMMODITIES COMPUTED ON THE BASIS: PRICES IN THE PRECEDING YEAR = 100

Average Number of Points on the Percentage Scale between the	Stocks	Commodities
Lowest and highest relative prices	119.9	95.1
First and ninth decils	44.4	25.7
Second and eighth decils	26.0	13.9
Third and seventh decils	15.7	7.8
Fourth and sixth decils	7.1	3.6
Lowest relative prices and first decils	17.7	27.0
First and second decils	7.1	4.9
Second and third decils	4.2	2.6
Third and fourth decils	3.8	2.2
Fourth decils and medians	3.6	1.8
Highest relative prices and ninth decils	57.9	42.4
Ninth and eighth decils	11.3	6.9
Eighth and seventh decils	6.1	3.5
Seventh and sixth decils	4.8	2.0
Sixth decils and medians	3.5	1.8

[1] For the decils of commodity prices see *Bulletin of the U.S. Bureau of Labor Statistics No. 173*, p. 17, and *Business Cycles*, p. 112. Both tables (the latter after extension) cover the years 1890–1913. The first includes all commodities quoted by the Bureau of Labor Statistics; the latter includes the 145 commodities used in the writer's revised form of the Bureau's index. For this list see *Bulletin No. 173*, p. 47, note.

TABLE XVI

AVERAGE ANNUAL DISPERSION OF THE RELATIVE PRICES OF STOCKS AND COMMODITIES COMPUTED ON THE BASIS: AVERAGE PRICES IN 1890–99 = 100

Average Number of Points on the Percentage Scale between the	Stocks	Commodities
Lowest and highest relative prices	440.5	170.9
First and ninth decils	208.7	53.7
Second and eighth decils	124.0	30.5
Third and seventh decils	74.7	18.1
Fourth and sixth decils	31.3	8.3
Lowest relative prices and first decils	34.7	33.8
First and second decils	20.0	8.7
Second and third decils	12.9	5.7
Third and fourth decils	14.5	4.6
Fourth decils and medians	14.7	4.3
Highest relative prices and ninth decils	197.1	83.4
Ninth and eighth decils	64.7	14.5
Eighth and seventh decils	36.4	6.7
Seventh and sixth decils	28.9	5.2
Sixth decils and medians	16.6	4.0

In just one respect stock fluctuations are more uniform than commodity fluctuations. Table XII shows that in two years since 1890 every stock in our representative list rose in price (1900–1901 and 1908–9), and that in one year every stock fell (1912–13). Such a thing seems never to happen in the commodity markets. There was no year in the period 1890–1913 when at least 8 per cent of the 240 commodities (more or less) quoted by the Bureau of Labor Statistics did not rise, when at least 16 per cent did not fall, and when at least 8 per cent did not remain unchanged in price. It is this greater uniformity in the general trend of stock fluctuations that explains the fact pointed out above, that stock index numbers agree rather better among themselves than do commodity indexes regarding the direction of the fluctuations, though they differ more regarding the degree.

The great obstacle in the way of measuring fluctuations in the prices of stocks, then, is their extreme diversity. Of course the representative value of averages is less when the data averaged are widely and irregularly scattered than when they are compactly and symmetrically grouped. Our problem, therefore, turns into the

question whether the data concerning changes in stock prices can be arranged in any fashion that gives a fairly compact and symmetrical grouping.

VII. ACTUAL PRICES, PERCENTAGES OF CHANGE FROM ONE YEAR TO THE NEXT, AND RELATIVE PRICES ON A FIXED BASE

One phase of this problem is to determine which of our three sets of measures—actual prices, percentages of change in price from one year to the next, or relative prices on the 1890–99 base—has the most compact and regular grouping of its constituent items. Some light has been thrown upon this question by Tables XIV–XVI; but we may settle it definitely by computing the percentage deviations of the individual entries in each set of measures from their respective arithmetic means and seeing in which case the deviations are least for the whole period of twenty-six years covered by the tables. Indeed it is not necessary to take each of the forty entries for each year; a computation limited to the materials presented in Tables XI–XIII—the highest and lowest items and the nine decils—will suffice.

The results, assembled in Table XVII, leave no room for doubt. Percentages of change from prices in the preceding year are much less scattered than actual prices or fixed-base relatives. That fact justifies the conclusion that stock index numbers made by averaging percentages of yearly change in prices are more reliable measures than are those made by averaging actual prices or fixed-base relatives.

What is less to be expected, the 1890–99 relative prices are distinctly less scattered than the actual prices. Therefore the index numbers in Table III, which are made by averaging relative prices (Nos. 1, 2, and 9), are more reliable than their fellows made from averages of actual prices, or the latter averages themselves, as shown in Table I. But these fixed-base relatives have a special defect: their degree of dispersion grows greater as we get farther and farther from the years that form the base. In 1910–15 they no longer have a decisive advantage over the actual prices, and as time goes on they may well have a decisive disadvantage. Table XVII shows that the other measures have no such inherent tendency

TABLE XVII

AVERAGE DEVIATIONS OF THE ACTUAL PRICES OF FORTY COMMON STOCKS, THEIR RELATIVE PRICES ON THE PRECEDING-YEAR BASE, AND THEIR RELATIVE PRICES ON THE 1890–99 BASE, FROM THE RESPECTIVE ARITHMETIC MEANS: ARITHMETIC MEANS MADE FROM DATA FOR EACH OF THE YEARS 1890–1915

(Based upon Tables XI–XIII and the corresponding arithmetic means in Tables I–III)

	PERCENTAGES BY WHICH THE LOWEST AND HIGHEST ENTRIES AND THE DECILS WERE LESS (−) OR GREATER (+) THAN THE CORRESPONDING ARITHMETIC MEANS											
	Grand Averages 1890–1915			Relative Prices on Preceding-Year Base			Relative Prices on 1890–99 Base			Actual Prices		
	Relative Prices on Preceding-Year Base (1)	Relative Prices on 1890–99 Base (2)	Actual Prices (3)	1890–91 to 1899–1900 (4)	1900–1901 to 1909–10 (5)	1910–11 to 1914–15 (6)	1890 to 1899 (7)	1900 to 1909 (8)	1910 to 1915 (9)	1890 to 1899 (10)	1900 to 1909 (11)	1910 to 1915 (12)
Lowest	−38	− 68	− 91	− 42	−31	−43	−62	− 62	− 88	− 91	− 88	− 96
First decil	−21	− 46	− 82	− 22	−19	−22	−31	− 47	− 69	− 83	− 77	− 88
Second decil	−13	− 34	− 73	− 14	−13	−11	−17	− 37	− 56	− 75	− 68	− 77
Third decil	− 9	− 26	− 63	− 10	− 9	− 7	−10	− 27	− 52	− 68	− 58	− 63
Fourth decil	− 5	− 19	− 47	− 7	− 6	− 2	− 5	− 18	− 42	− 58	− 39	− 42
Median	− 2	− 11	− 27	− 3	− 2	+ 1	− 1	− 10	− 31	− 43	− 19	− 13
Sixth decil	+ 1	− 3	+ 1	± 0	+ 1	+ 4	+ 4	− 1	− 17	− 6	+ 3	+ 9
Seventh decil	+ 5	+ 12	+ 35	+ 4	+ 6	+ 8	+10	+ 10	+ 19	+ 40	+ 35	+ 27
Eighth decil	+11	+ 29	+ 69	+ 9	+12	+12	+17	+ 27	+ 55	+ 93	+ 60	+ 47
Ninth decil	+21	+ 62	+103	+ 22	+22	+17	+29	+ 63	+115	+123	+ 97	+ 80
Highest	+70	+162	+305	+103	+49	+48	+72	+165	+307	+280	+273	+399
Range between first and ninth decils	42	108	185	44	41	39	60	110	184	206	174	168

to scatter with the lapse of time. Of course this fact explains why the index numbers on the 1890–99 base differ more from each other in 1910–15 than in 1900–1909, and in 1900–1909 than in 1890–99 (Table VI).[1]

VIII. ARITHMETIC MEANS, GEOMETRIC MEANS, AND MEDIANS

In one respect even the best groupings of Table XVII are asymmetrical: the average deviations from the arithmetic means run farther up the percentage scale than they run down. Similarly, in Tables XI–XIII the margins between the medians and the ninth decils are wider than the margins between the medians and the first decils. A method of grouping the data which produced a better balance on either side of the average would make the average itself a more representative figure.

The obvious experiment to try in seeking a better-balanced distribution is a regrouping along a geometric instead of an arithmetic scale; that is, we may treat an entry which equals twice the arithmetic mean of its series as balanced by another entry which equals half the arithmetic mean, etc. On the arithmetic scales used so far these entries would not balance—one would be 100 points above the mean, the other 50 points below. The deviations of the highest and lowest entries and the nine decils of Tables XI–XIII from their respective arithmetic means have already been computed for each year as materials for Table XVII, and we have only to rearrange them in new form to try this experiment. Instead of making twenty-six-year averages we make frequency tables—that is, tables showing the number of times deviations of each given magnitude occur. Then we draw up a geometric scale

[1] In a footnote to the last paragraph of Section III it was pointed out that relative prices are merely actual prices altered by the application of certain multipliers or divisors—that is, they are weighted actual prices. The conclusions of this section may therefore be rephrased as follows: (1) the prices of stocks are more compactly grouped and therefore yield more significant averages when they are weighted by the factors required to make the price of each stock in the preceding year equal 100 than when they are weighted by the factors required to make the prices of each stock in some fixed period equal 100; and (2) the latter weighting in turn yields better groupings and therefore more significant averages than the unweighted actual prices so long as the period selected as base lies not too long in the past. If the equivalence of these statements and those made in the text is not at once clear, the reader may turn for explanations to Section X.

of deviations from the arithmetic means by choosing a convenient series of numbers to be used both as multipliers and as divisors. When used as multipliers, these numbers give values greater than the arithmetic mean—and these values constitute our scale of deviations above the mean. When used as divisors, they give a corresponding scale of deviations below the means. Then we have only to count and enter the number of deviations in our frequency table falling within the successive intervals marked by our geometric scale. Table XVIII gives the finished results.[1]

The experiment is an unqualified success so far as relates to percentages of change from one year to the next. They are admirably balanced in this table—much better balanced than on an arithmetic scale. For these fluctuations, then, the geometric mean is a more significant average than the arithmetic mean. The same conclusion may be drawn, though with less emphasis, regarding the 1890–99 relatives. They balance better on a geometric than on an arithmetic scale; but they balance less evenly on either scale than do the relatives on the preceding-year base. As for the actual prices, it cannot be said that they are symmetrically grouped on either scale. The geometric distribution may not be quite so bad as the other, but neither distribution is good. Index numbers made by averaging actual prices of stocks, therefore, have less representative value than those made by averaging relative prices—always excepting, for reasons given above, relative prices computed on a fixed base more than, say, ten years past.[2]

It is interesting to compare the best of our distributions of data for stocks with the distribution of corresponding data for commodities. The latter data are ready to hand, not in the form of

[1] Compare the experiment tried and the conclusion drawn by Mr. F. R. Macaulay with reference to decils of relative prices of commodities on the preceding-year base (one of the tables in *Bulletin of the U.S. Bureau of Labor Statistics, No. 173*) (*American Economic Review*, VI, 205–7 [March, 1916]).

[2] Even so, geometric means of actual prices have one special advantage: they can be turned at once into geometric means of relative prices on any base that is desired—the preceding year, 1890–99, 1890–1915, the last completed year, etc. As was shown in Section V above, the arithmetic means or medians of actual prices, on the contrary, do not yield arithmetic means or medians of relative prices: if the latter are required, the relative prices must be computed and averaged or an equivalent set of weights must be applied to the actual prices. If an explanation of this difference is wanted, see "The Making and Using of Index Numbers," pp. 83–86.

TABLE XVIII

GEOMETRIC DISTRIBUTION OF DEVIATIONS OF THE ACTUAL AND RELATIVE PRICES OF FORTY COMMON STOCKS IN THE YEARS 1890–1915 FROM THEIR RESPECTIVE ARITHMETIC MEANS

(Based upon the highest and lowest figures and the nine decils of actual prices, relative prices on the preceding-year base, and relative prices on the 1890–99 base, as shown in Tables XI–XIII, and upon the corresponding arithmetic means, as shown in Tables I–III)

Series of Multipliers and Divisors	Resulting Scales of Percentage Deviations from the Arithmetic Means		Relative Prices on the Preceding-Year Base		Relative Prices on the 1890–99 Base		Actual Prices	
	Deviations below the Arithmetic Means	Deviations above the Arithmetic Means	No. of Deviations below the Arithmetic Means	No. of Deviations above the Arithmetic Means	No. of Deviations below the Arithmetic Means	No. of Deviations above the Arithmetic Means	No. of Deviations below the Arithmetic Means	No. of Deviations above the Arithmetic Means
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1.0– 1.09.....	99.9–91.0	100– 109	66	60	27	29	4	11
1.1– 1.19.....	90.9–83.4	110– 119	33	29	28	25	15	5
1.2– 1.29.....	83.3–77.0	120– 129	21	14	13	14	6	7
1.3– 1.39.....	76.9–71.5	130– 139	13	6	8	9	3	14
1.4– 1.49.....	71.4–66.8	140– 149	4	1	10	5	1	7
1.5– 1.59.....	66.7–62.6	150– 159	1	4	13	10	4	7
1.6– 1.69.....	62.5–58.9	160– 169	1	1	7	2	9	6
1.7– 1.79.....	58.8–55.7	170– 179	1	3	5	2	2	6
1.8– 1.89.....	55.6–52.7	180– 189	2	1	3	4	3	8
1.9– 1.99.....	52.6–50.1	190– 199	1	1	7	1	4	5
2.0– 2.19.....	50.0–45.6	200– 219	2	4	11	3	7	12
2.2– 2.39.....	45.5–41.8	220– 239	1	1	3	7	4	6
2.4– 2.59.....	41.7–38.6	240– 259	2	.....	5	.....	4	2
2.6– 2.79.....	38.5–35.8	260– 279	.....	.....	3	4	10	1
2.8– 2.99.....	35.7–33.4	280– 299	.....	.....	3	3	9	.....
3.0– 3.99.....	33.3–25.1	300– 399	.....	1	4	3	24	10
4.0– 4.99.....	25.0–20.1	400– 499	1	.....	4	3	12	8
5.0– 5.99.....	20.0–16.8	500– 599	.....	.....	2	.....	9	5
6.0– 6.99.....	16.7–14.4	600– 699	.....	.....	1	.....	9	.....
7.0– 7.99.....	14.3–12.6	700– 799	.....	.....	2	.....	3	.....
8.0– 8.99.....	12.5–11.2	800– 899	.....	.....	.....	.....	1	.....
9.0– 9.99.....	11.1–10.1	900– 999	.....	.....	.....	.....	2	.....
10.0–19.99.....	10.0– 5.1	1,000–1,999	.....	.....	2	.....	13	.....
20.0–29.99.....	5.0– 3.4	2,000–2,999	.....	.....	1	.....	6	.....
30.0–49.99.....	3.3– 2.1	3,000–4,999	.....	.....	.....	.....	.....	.....
50.0–99.99.....	2.0– 1.9	5,000–9,999	.....	.....	.....	.....	1	.....
100.0.....	1.0 and less	10,000 and more	.....	.....	.....	.....	1	.....
Sums.....	.....	.....	149	126	162	124	166	120
			275		286		286	

deviations from arithmetic means, but in the form of percentages of yearly rise or fall in price. However, these percentages can readily be distributed on a geometric scale and compared with the similar percentages of change in the prices of stocks. Table XIX brings the two sets of figures together. In both cases the grouping is highly symmetrical, more symmetrical than the groupings on the arithmetic scale; hence the geometric mean is technically a better average than the arithmetic mean for year-to-year fluctuations in the prices of commodities as well as for fluctuations in the prices of stocks. Further, the commodity fluctuations are more highly concentrated in the center of the field than stock fluctuations, and their extremes cover a narrower range, so that with equally representative samples to use, the index numbers of commodity prices have higher representative value than the index numbers of stock prices.

So far the argument runs: geometric means are more significant averages of price fluctuations, whether of commodities or stocks, than arithmetic means, because they are the averages of more symmetrical distributions. What, then, of medians? They have high representative value when the distribution shows concentration about the middle members of the series, and when the scattering cases of wide deviation on either side of the middle possess little significance. Tables XI–XIII show that the arithmetic means of the distributions under discussion must be unduly influenced by a few extremely high actual or relative prices. On the other hand, Table XVIII shows that the geometric means of actual prices, and in less measure of the 1890–99 relatives, are in danger of distortion from the occurrence of numerous exceptionally low values, not counterbalanced by offsetting high values. Does it follow, then, that medians are better averages of these data than either of their rivals?

Certainly we found in Section IV that the index numbers based upon medians of actual prices (column 4, Tables II and III) are highly erratic. On the average they jump more from one year to the next than any of the other series, and on the average they show the widest disagreement with the other series (Table V). Moreover, in one year this series contradicts the evidence of ten other series, indicating that stock prices advanced in 1910, while all the others say that stocks fell. When one looks back to the figures

from which the medians are taken, the drop in this year seems most unrepresentative of the general trend. After the actual prices of all forty stocks in 1909 and 1910 have been ranged in order of magnitude, it appears that in thirty-four cases the 1910 entries are lower than those of the preceding year and in only six cases higher; but two of these six cases happen to fall in the center of the series. The fact is that the actual prices show little of that concentration about the middle members of the series which is required to give the medians stability and significance. Instead of concentration there is often a wide gap between the twentieth and the twenty-first entries—a gap which often exceeds $5.00 per share, and once exceeds $25.00. The odds are that the addition to or subtraction from our list of one stock taken at random would make a greater difference in the medians than in the arithmetic or the geometric means.

Similar defects, though in lesser degree, beset the medians of relatives on the 1890–99 base. This series (Table III, No. 1) differs from all the others by saying that stock prices fell in the highly prosperous year 1906. On turning to the full array of these relatives for 1905 and 1906 we find that only ten of the forty entries arranged in numerical order show a decline; but two of these ten happen to be in the strategic position of fixing the median.

To conclude: If quotations could be found for two or three times the number of stocks employed here, it is probable that the distribution of the data would be rendered more regular. Then the actual prices might be grouped about their central tendency with sufficient symmetry to yield averages of high representative value. Even the medians might lose that erratic character which they now have and become excellent averages. But with only forty stocks as samples it must be confessed that averages of actual prices, whatever mean be tried, are open to question.[1] One

[1] This remark concerning the series including forty stocks applies a fortiori to the *Wall Street Journal's* series for twenty railways, to the *Annalist's* averages for twenty-five railways, and to other index numbers of stocks built upon an even narrower foundation. It is quite possible that the actual prices from which these smaller series are made show a less irregular grouping than my forty stocks. But to accomplish that result there must be arbitrary selection of the samples. If the data are made more uniform by that means, they become at the same time less representative of the whole situation.

TABLE XIX

GEOMETRIC DISTRIBUTION OF THE RELATIVE PRICES OF STOCKS AND COMMODITIES ON THE PRECEDING-YEAR BASE

(Made from the data used for Table XII above [forty stocks, 1890–1915], and for Tables 2 and 4, *Bulletin of the U.S. Bureau of Labor Statistics, No. 173* [240± commodities, 1890–1913])

SERIES OF MULTIPLIERS AND DIVISORS	SCALES OF RELATIVE PRICES ON PRECEDING-YEAR BASE RESULTING FROM USE OF THE SERIES OF MULTIPLIERS AND DIVISORS		NUMBER OF TIMES PER MILLE EACH RELATIVE PRICE OCCURRED					
			Falling Prices		No Change in Price		Rising Prices	
	Falling Prices	Rising Prices	Commodities	Stocks	Commodities	Stocks	Stocks	Commodities
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1.00					125	6		
1.001–1.09	99.9–91.0	100.1–109	263	211			180	290
1.10 –1.19	90.9–83.4	110 –119	92	129			104	101
1.20 –1.29	83.3–77.0	120 –129	32	69			68	39
1.30 –1.39	76.9–71.5	130 –139	14	39			34	15
1.40 –1.49	71.4–66.8	140 –149	7	21			21	8
1.50 –1.59	66.7–62.6	150 –159	3	18			17	3
1.60 –1.69	62.5–58.9	160 –169	2	11			11	2
1.70 –1.79	58.8–55.7	170 –179	1.3	8			7	1
1.80 –1.89	55.6–52.7	180 –189	.4	7			5	.6
1.90 –1.99	52.6–50.1	190 –199	.2	2			5	
2.00 –2.19	50.0–45.6	200 –219	.1	2			5	.4
2.20 –2.39	45.5–41.8	220 –239		2			6	
2.40 –2.59	41.7–38.6	240 –259		1			4	
2.60 –2.79	38.5–35.8	260 –279					1	
2.80 –2.99	35.7–33.4	280 –299		2			1	
3.00 –3.99	33.3–25.1	300 –399					1	
4.00 –4.99	25.0–20.1	400 –499		1				
5.00 –5.99	20.0–16.8	500 –599					1	
Totals			415.0	523	125	6	471	460.0

SUMMARY

Totals.....	.....	.....	415.0	523	125	6	471	460.0

SUMMARY

	Total No. of Cases Observed	No. of Cases in Which Prices			No. of Cases per Mille in Which Prices			Medians of All Cases	Arithmetic Means of All Cases
		Fell	Did Not Change	Rose	Fell	Did Not Change	Rose		
Stocks.....	1,000	523	6	471	523	6	471	99.05	104.35
Commodities.....	5,578	2,314	697	2,567	415	125	460	100.00	101.36

set of fluctuations, however, can be measured rather accurately—even when no more than forty stocks are included—namely, the average percentages of change in price from one year to the next. For such measurements the geometric mean has been shown to be technically the most significant average. Further, it seems fair to say that relative prices on a fixed base yield acceptable (though less excellent) averages with a sample no larger than forty, so long as the computation is not carried many years beyond the base period.[1] In averaging these fixed-base relatives, also, the geometric mean is technically preferable to the arithmetic mean or median.

IX. THE KINDS OF STOCKS INCLUDED

Students of commodity index numbers have found that the various groups into which commodities are divided by conditions of supply and demand exhibit characteristically different types of fluctuation in prices. Raw materials as a class vary more in price than manufactured goods. Among raw materials the prices of mineral products depend largely upon the activity of business; the prices of farm crops and, in a somewhat different way, the prices of animal products depend largely upon the weather, while the prices of forest products in America at present show the influence of the progressive reduction of natural resources. Among manufactured articles staple consumers' goods are steadier in price than staple producers' goods, trust-made goods are steadier than strictly competitive products, etc.[2]

In making and in using commodity index numbers it is highly important to recognize the existence and the characteristics of these groups, for the differences among them are so wide as to determine the behavior of the series into which they enter in different proportions. The ideal procedure is to include enough commodities of each group to secure a fair sample, to make for each group a

[1] If the fixed-base relatives in the preceding tables were recomputed on the 1890–1915 base, it is probable that the figures would show more regular distribution than the 1890–99 relatives, to say nothing of the actual prices. But even these new relatives would probably become badly scattered and therefore of questionable value after the lapse of ten or fifteen years more.

[2] All these propositions, except the last, are demonstrated in "The Making and Using of Index Numbers," *Bulletin of the U.S. Bureau of Labor Statistics, No. 173*, pp. 52–71.

separate series of index numbers, and then to combine all of these series in a properly weighted average to ascertain the changes in the wholesale price level at large.

Although we found in Section V that the sample used in a stock index number makes less difference in the results than is made by the form of average chosen, the scheme of weights applied, or the stage at which actual prices are reduced to relatives, still it is proper to inquire whether there are among stocks, as among commodities, distinct groups which demand recognition in making index numbers.

Stocks are of course classified in many different ways, and for several of the resulting groups separate index numbers have been computed. (1) The *Wall Street Journal* and other financial papers publish independent series for railway stocks and "industrials." The chief difference between these index numbers is that the industrials vary even more in price than the railways.[1] This distinction, based on the nature of the business transacted, is clearly important and deserves to be developed further whenever the data permit: separate index numbers for the stocks of, say, mining and smelting companies, iron and steel companies, machinery and equipment concerns, textile factories, public utilities, etc., would prove highly significant if enough quotations could be had to make trustworthy averages for each group.

My own figures have been confined to the stocks of transportation companies, not from choice, but because few other stocks have been regularly quoted throughout the rather long period I started to study. But among these transportation stocks I have found several interesting groups, for which index numbers are assembled in Table XX. It will be noticed that the number of

[1] A comparison between annual averages struck from the *Wall Street Journal's* monthly highest and lowest figures for twenty railway and for twelve industrial stocks in 1897–1914 shows the average change from one year to the next to be 12.1 per cent for the first group and 14.3 per cent for the second. On the other hand, the net change between 1897 and 1914 is a rise of 73 per cent for railways and of 70 per cent for industrials. This latter result, however, may be quite untrustworthy, not only because of the above-demonstrated difficulty of making long-period comparisons of stock prices, but also because of changes made from time to time in the *Journal's* lists of stocks, the small number of securities included, and the doubtful value of arithmetic means of actual prices. In three years out of eighteen (this time including 1915) the two series have moved in opposite directions.

TABLE XX

INDEX NUMBERS SHOWING THE DIVERSITY OF FLUCTUATIONS AMONG DIFFERENT GROUPS OF STOCKS. ARITHMETIC MEANS OF RELATIVE PRICES COMPUTED ON THE 1890–99 BASE

	Ten Stocks Paying Dividends Every Year	Preferred and Common Stocks in the Same Ten Railways		Common Stocks Classified according to Average Actual Prices in 1890–99			Common Stocks Classified by Character of Business and Territory Served						
		Preferred	Common	17 Stocks Worth Less than $25 per Share	13 Stocks Worth $25–$99 per Share	10 Stocks Worth Over $100 per Share	5 North Atlantic Railways	4 Anthracite Coal-carrying Railways	6 Southern Railways	8 Middle-western Railways	7 North-western Railways	5 Pacific Railways	5 Express, Steamship, and Telegraph Companies
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
1890	104	108	113	125	127	106	113	117	132	120	105	144	117
1891	100	104	113	118	115	101	108	106	123	118	94	134	108
1892	105	115	124	128	126	107	119	135	114	128	119	139	108
1893	96	87	89	92	92	99	97	97	84	93	92	99	96
1894	94	82	82	76	77	95	89	95	78	83	*76*	65	89
1895	95	87	87	85	79	95	89	89	82	93	85	68	91
1896	*92*	85	*81*	*73*	*72*	*91*	*86*	88	*67*	77	78	*64*	*85*
1897	94	94	90	78	84	93	90	89	89	*76*	88	67	91
1898	102	107	97	89	98	100	95	*84*	98	93	100	87	99
1899	118	130	126	136	129	114	115	99	134	120	164	132	117
1900	121	133	144	147	130	116	110	99	151	123	180	145	108
1901	142	178	262	271	186	140	158	144	259	206	267	259	137
1902	157	*191*	*305*	325	221	161	162	181	297	*256*	*332*	292	171
1903	136	163	238	246	187	141	133	161	259	188	245	236	151
1904	136	156	215	221	192	142	130	170	250	174	214	240	153
1905	158	181	278	297	248	173	*186*	255	325	214	281	306	176
1906	*159*	180	291	319	265	183	177	305	341	227	289	363	*178*
1907	129	138	206	225	214	155	127	245	269	153	190	320	152
1908	126	130	195	218	214	157	125	270	246	150	192	326	142
1909	150	169	280	*332*	*271*	*193*	159	340	*358*	201	296	*445*	177
1910	142	148	248	301	260	166	141	331	349	197	243	406	148
1911	137	138	233	296	253	160	140	328	345	178	244	405	137
1912	141	132	215	278	257	165	138	361	345	190	219	396	139

1909	150	169	280	*332*	*271*	*193*	159	340	*358*	201	296	*445*	177
1910	142	148	248	301	260	166	141	331	349	197	243	406	148
1911	137	138	233	296	253	160	140	328	345	178	244	405	137
1912	141	123	215	278	257	165	138	*364*	347	173	210	397	130
1913	121	104	184	234	224	135	115	320	295	147	175	353	91
1914	107	84	155	190	206	122	96	304	256	111	149	309	85
1915	109	*81*	162	197	200	127	109	310	251	111	150	305	91
Averages													
1890–1899	100	100	100	100	100	100	100	100	100	100	100	100	100
1900–1909	141	162	241	260	213	156	147	217	276	189	249	293	155
1910–1915	126	113	200	249	233	146	123	326	307	153	195	363	114
1890–1915	122	127	177	196	174	132	123	197	215	147	179	235	124
Net rise (+) or fall (−)													
1890–1896	−12	−23	− 32	− 52	− 55	− 15	− 27	− 29	− 65	− 43	− 27	− 80	−32
1896–1909	+58	+84	+199	+259	+199	+102	+ 73	+252	+291	+124	+218	+381	+92
1909–1915	−41	−88	−118	−135	− 71	− 66	− 50	− 30	−107	− 90	−146	−140	−86
1890–1915	+ 5	−27	+ 49	+ 72	+ 73	+ 21	− 4	+193	+119	− 9	+ 45	+161	−26
Difference between highest and lowest	67	110	224	259	199	102	100	280	291	180	256	381	93
Average change from one year to the next	9.7	16.0	30.7	36.3	21.2	12.4	15.8	24.9	26.4	24.7	35.9	32.6	14.2

NOTE.—The entries italicized in each series are the highest and lowest within the period covered.

stocks included in at least half of these groups is so small that the averages have no great value. (2) Stocks which pay dividends regularly are steadier in price both from year to year and over long periods of time than other stocks.[1] The summaries of column 1 of the table present a marked contrast to those of the other columns. (3) As a group preferred stocks are steadier than common stocks in the same railways. (4) Stocks that were already high-priced in 1890–99 have varied less from year to year and risen less since then than stocks that were then low-priced.[2] (5) The geographical groups of columns 7–12 represent many striking divergences which it is needless to write out in detail. (6) Sensational differences would appear if separate index numbers were computed for the "Harriman stocks," the "Vanderbilt stocks," the "Gould stocks," etc., as one may judge by looking back at Tables VIII and X. (7) The stocks largely traded in on the Stock Exchange behave somewhat differently from the less active list.[3] (8) Other contrasts would probably appear if the

[1] For the names of the ten dividend-paying stocks see *Business Cycles*, p. 203, n. 76.

[2] A similar comparison based upon average actual prices for the whole period 1890–1915 yields the following summary:

	Percentage of Change in Price from One Year to the Next		
	Average	Highest for Any Stock	Lowest for Any Stock
	Per Cent	Per Cent	Per Cent
Fourteen stocks having average prices above $100 in 1890–1915	11.4	16.8	6.1
Twelve stocks having average prices of $40–$99 in 1890–1915	20.0	28.4	7.7
Fourteen stocks having average prices below $40 in 1890–1915	28.8	45.0	18.2

The names of the stocks included in these three groups may be made out from Table VIII, column 1.

[3] I have carried this comparison far enough to make out that the most active stocks in 1890–1914 *as a group* have varied less in price from one year to the next than other groups in which transactions were smaller. However, the following summary which establishes this result raises more questions than it answers. It will be noticed that *within* the groups there is some evidence of correspondence between amount of sales and variability in price. Perhaps a more instructive comparison could be made by taking ratios between sales and amount of stock outstanding as the basis for com-

railways that have increased their stock issues largely were segregated from those that have not; (9) if the railways that have and have not undergone reorganization within the period covered were separately treated, etc.

One might go on at considerable length with this catalogue of groups; but the list as it stands is long enough to bring out the significant conclusions. (1) Such groups are important for the

parison. Or the inquiry might be elaborated by taking each year by itself and comparing ratios of change with amounts or ratios of sales.

	Thousands of Shares Sold Yearly; Averages for 1890–1914	Average Change in Price from One Year to the Next
		Per Cent
Union Pacific	11,969	28.4
Reading	6,891	28.0
Chicago, Milwaukee & St. Paul	5,477	12.6
Southern Pacific	4,285	16.6
Atchison, Topeka & Santa Fe	3,735	22.7
Erie	2,823	25.1
Missouri Pacific	2,333	24.0
Pennsylvania	1,907	6.1
Louisville & Nashville	1,542	13.2
New York Central	1,430	10.0
Chesapeake & Ohio	1,182	19.1
Canadian Pacific	1,005	12.1
Averages for the group	.....	18.2
New York, Ontario & Western	877	18.2
Western Union	737	9.2
Norfolk & Western	617	26.2
Missouri, Kansas & Texas	603	26.0
Texas & Pacific	596	25.9
Chicago & Northwestern	463	10.3
Illinois Central	351	7.6
Pacific Mail	316	20.5
Delaware & Hudson	299	8.7
Wabash	279	28.2
Cleveland, Cincinnati, Chicago & St. Louis	279	18.8
Delaware, Lackawanna & Western	236	11.2
Wheeling & Lake Erie	227	30.9
Denver & Rio Grande	220	27.4
Central of New Jersey	219	16.8
Averages for the group	.....	19.8
Wisconsin Central	159	45.0
Chicago, St. Paul, Minneapolis, & Omaha	148	16.6
Canada Southern	132	7.7
Iowa Central	89	26.9
New York, Chicago & St. Louis	88	23.2
Pittsburgh, Cincinnati, Chicago & St. Louis	84	23.2
New York, New Haven & Hartford	81	9.8
Lake Erie & Western	73	27.2
Minneapolis & St. Louis	70	38.7
Duluth, South Shore & Atlantic	42	31.3
United States Express	15	16.6
American Express	12	10.5
Wells Fargo	6	13.9
Averages for the group	.....	22.4

NOTE.—The number of shares sold has been divided by two in case of the stocks having a par value of $50.

maker of index numbers in proportion as they rest upon factors which affect the prices of stocks. For instance, it is necessary to have all the geographical groups represented only so far as there is a characteristic difference in the pace at which railway traffic grows in the East and West, the North and South; or in the way in which railway finances are managed in different sections; or in the policy of different state commissions toward railways, etc. (2) In so far as the groups do rest upon factors which affect prices they overlap so much that the stocks within a given group usually present wide contrasts of behavior. For example, in the Pacific group we find Union Pacific beside Denver & Rio Grande; in the southern group Norfolk & Western beside Missouri Pacific, etc. (compare Tables VIII and X). (3) Many of the groups are unstable: the price-controlling factors which lend them significance have little in common with the physical conditions of supply which mark off, say, farm crops from mineral products. Stocks come into and pass out of the dividend-paying class; the active stocks of one year are inactive later; the "Harriman stocks" are not a "natural kind," etc. Indeed, new groupings may arise at any time to eclipse the older ones in importance, as the "war-stocks" appeared in 1914–15.

Since classification of stocks on the basis of factors affecting fluctuations in price is more complicated and unstable than the similar classification of commodities, one must be content with less definite rules of procedure. One can hardly say more than this: So far as your means allow, in each investigation include all the stocks for which you can find satisfactory quotations; arrange them in all the ways that appear significant for your purpose and find what peculiarities of fluctuation each group exhibits; make clear to yourself and to others what part of the field your groups and your totals cover and what parts they omit.

X. WEIGHTING

So long as statisticians expected but rough results from their index numbers of commodity prices at wholesale, they treated systematic weighting as a theoretical refinement in method which made little difference in the results. What pleased them was to

find that their simple and weighted averages showed the same general trend. But as experience has demonstrated that under favorable circumstances the margin of uncertainty in such work may be reduced to less than, say, 10 per cent of the results, makers of commodity index numbers have begun to regard proper weighting as practically important. Is it important also in making index numbers of stock prices?

Hitherto most stock indexes have been "simple" averages of actual or relative prices.[1] Now simple averages are not averages into which no weights enter, or in which all stocks have the same weights; they are really averages in which the weights have not been systematically planned but left to chance. What degree of influence any stock in a given sample will exercise upon the results in a simple series depends both upon the original quotations and upon the way in which they are worked up. For example, an arithmetic mean of actual prices in effect assigns heavy weights to the stocks that command high prices per share and light weights to stocks that are cheap. But if these actual prices are turned into relatives and the arithmetic means are made from the latter figures, the weighting is likely to be revolutionized. For now the influence of a given stock depends on a radically different factor, not on its price in dollars and cents as compared with the prices of other stocks in the sample, but on the percentage which the price on the date in question bears to the price of the same stock in the period chosen as base as compared with the corresponding percentages for the other stocks. A shift to a new base commonly alters the relative magnitude of these percentages and therefore changes the weights once more. Finally, the substitution of geometric means or medians for arithmetic means gives an entirely new twist to the whole situation. In a geometric mean the influence of a stock depends upon the comparative magnitude of the *ratios* of change

[1] The few weighted series have been averages of all stocks sold on a given exchange (for example, Table I, series 8), or they have been aggregates of the amounts of the several securities outstanding, multiplied by their current prices. In both cases the weights have been subject to alteration. Hence the weighted series have shown the combined results of *two* sets of changes, and therefore have not been clear-cut measures of fluctuations in prices. The confusion is particularly serious in the series from the *Financial Review*, given in Table I.

which its price undergoes, and it matters not whether actual or relative prices are used or on what base the relative prices are computed, for none of these matters affect the ratios of change, which alone count. In a median it does make a difference whether actual or relative prices are averaged and on what base the relatives are computed; but the influence which any stock exercises upon the result depends solely on whether its actual or relative price happens to be at, above, or below the middle of the whole series after the data have been arranged in numerical order. The magnitude of its deviation from the middle position has no effect.

Since all index numbers are really weighted, the only question is whether these weights should be tacit or avowed, obscure or clear, left to chance or controlled on some intelligible principle. This question is one of great moment, particularly when one is dealing with stocks. For we found in Section V that different schemes of systematic weighting produce large differences in results, when the weights themselves differ notably. We also found that the different schemes of haphazard weighting tacitly introduced by changing from averages of actual prices to averages of relatives, or by shifting the base on which relatives are computed, cause wide divergences. Finally, in most cases the series with systematic weights and the series with haphazard weights differ from each other at least as much as they differ among themselves. If systematic weighting is desirable in making commodity indexes where it leads to comparatively moderate differences in results, a fortiori it is desirable in making stock indexes where the differences produced in results are much wider.

Few men would hesitate to say that the price of Pennsylvania stock is more important than the price of Duluth, South Shore & Atlantic stock and deserves to have more weight in an index number. It is more important because there is more Pennsylvania stock in the hands of investors, individual and corporate; because the Pennsylvania does much the bigger business; because Pennsylvania stock is a more important article of commerce—more of it changes hands year by year.

These three reasons imply three different criteria of the importance of a given stock, criteria upon which may be based three sets

of weights, each of which is appropriate for special ends. If the aim is to show the average changes in the prices of securities held by the public, the amount of stock outstanding yields the logical set of weights. If the aim is to throw light on the changes in the prices of business enterprises as such, then gross earnings, the best available gauge of volume of business transacted, may be used as weights. If the aim is to find average changes in the prices of stocks that are traded in, then the number of shares sold should be used. Other aims might make still other systems of weights desirable. The three enumerated are all that I have worked out. How they compare with one another is shown by columns 4, 5, and 6 of Table XXI.[1]

But to what ought these weights be applied—to actual prices or to relative prices worked out on some chosen base? That is equivalent to the question: What weights ought to be used on the actual prices? For any average of relative prices is itself a weighted average of actual prices in disguise. For example, the preceding index numbers made by averaging relative prices on the 1890–99 base are equivalent to averages of actual prices weighted by the factors required to make the average actual price of each stock in that decade equal 100. What these factors are, after reduction to the scale of 100.0 for the sake of comparison with the other systems of weights, is shown in column 3 of Table XXI.[2]

[1] In all three systems arithmetic means for the twenty-five years 1890–1914 have been used. A high degree of accuracy cannot be claimed for the original data, which were compiled from the supplements of the *Commercial and Financial Chronicle* and the *Financial Review*, eked out by the use of railway and stock-exchange manuals. Probably the statistics of shares sold are the most accurate on the whole, though a few interpolations were necessary here, e.g., to supply data for Pennsylvania in 1890–96. The amount of stock outstanding in a given year is not always reported alike in two different sources, and statistics of earnings are often confused by changes in the fiscal year, changes in methods of accounting, etc. In particular the earnings of express companies in the years before the Interstate Commerce Commission was empowered to require reports from them had to be interpolated on the assumption that in earlier years they bore the same ratio to the earnings of the railways that they have borne since. But after all allowances are made, it is probable that each of these three sets of weights is a closer approximation to what the figures purport to show than can be reached in making weights for a large index number of commodity prices at wholesale.

[2] For example, the average price of Chesapeake & Ohio stock in 1890–99 was $20.81, and its average price in 1915 was $47.70. Its relative price in 1915 on the

TABLE XXI

DATA CONCERNING THE WEIGHTED INDEX NUMBERS OF THE ACTUAL PRICES OF COMMON STOCKS IN FORTY TRANSPORTATION COMPANIES

	Average Prices in 1890–1915		Weights Implicit in Averages of Relative Prices Computed on the 1890–99 Basis	Weights Based upon Average			Percentages of the Totals Made from Average Actual Prices in 1890–1915 Multiplied by Weights			
	In Dollars and Cents (1)	In Percentages of the Total (2)	(3)	Amount of Stock Outstanding in 1890–1914 (4)	Earnings of Companies in 1890–1914 (5)	Number of Shares Sold in 1890–1914 (6)	Implicit in 1890–99 Relatives (7)	Based on Stock Outstanding (8)	Based on Earnings (9)	Based on Shares Sold (10)
Total, forty stocks	$3,227.50	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
North Atlantic railways	470.83	14.6	82	27.8	24.4	13.7	8.8	32.3	27.6	12.0
New York, New Haven & Hartford	178.82	5.5	3	3.5	3.7	0.1	1.3	7.0	6.7	0.2
New York, Ontario & Western	28.71	0.9	34	2.5	0.5	1.7	2.3	0.8	0.1	0.6
New York Central	116.24	3.6	6	6.3	6.4	2.8	1.7	8.2	7.5	4.0
Pennsylvania	121.24	3.8	5	11.0	10.0	3.7	1.4	15.0	12.3	5.5
Erie	25.82	0.8	34	4.5	3.8	5.4	2.1	1.3	1.0	1.7
Anthracite coal railways	722.04	22.4	38	6.6	8.3	14.7	11.7	11.6	15.0	16.4
Central Railroad of New Jersey	181.13	5.6	6	1.1	1.7	0.4	2.6	2.3	3.1	0.9
Delaware & Hudson	151.52	4.7	5	1.6	1.3	0.6	1.8	2.7	2.0	1.1
Delaware, Lackawanna & Western	310.63	9.6	4	1.2	2.4	0.4	3.0	4.2	7.6	1.5
Reading	78.76	2.5	23	2.7	2.9	13.3	4.3	2.4	2.3	12.9
Middle-western railways	385.01	11.9	232	10.2	11.5	2.8	16.9	7.7	7.9	2.0
Cleveland, Cincinnati, Chicago & St. Louis	61.00	1.9	13	1.5	1.8	0.5	1.9	1.0	1.1	0.3
Wheeling & Lake Erie	13.26	0.4	36	0.7	0.4	0.4	1.1	0.1	0.1	0.1
New York, Chicago & St. Louis	33.14	1.0	41	0.6	0.7	0.2	3.3	0.2	0.2	0.1
Wabash	12.26	0.4	68	1.6	1.8	0.5	2.0	0.2	0.2	0.1
Pittsburgh, Cincinnati, Chicago & St. Louis	59.29	1.8	24	1.2	2.4	0.1	3.4	0.8	1.3	0.1
Canada Southern	60.42	1.9	11	0.7	0.6	0.3	1.6	0.5	0.4	0.2
Lake Erie & Western	23.14	0.7	33	0.5	0.4	0.1	1.8	0.1	0.1	0.1

Pittsburgh, Cincinnati, Chicago & St. Louis	12.26	0.4	68	1.6	1.8	0.5	2.0	0.2	0.2	0.1
	59.29	1.8	24	1.2	2.3	0.1	3.4	0.8	1.3	0.1
Canada Southern	60.42	1.9	11	0.7	0.6	0.3	1.6	0.5	0.4	0.2
Lake Erie & Western	23.14	0.7	33	0.5	0.4	0.1	1.8	0.1	0.1	0.1
Illinois Central	122.50	3.8	6	3.4	3.6	0.7	1.8	4.8	4.5	1.0
Northwestern railways	456.94	14.2	282	8.7	11.4	12.4	18.1	10.3	13.2	16.9
Chicago, Milwaukee & St. Paul	114.05	3.5	8	3.0	4.4	10.5	2.2	3.8	5.0	14.6
Chicago & Northwestern	147.50	4.6	5	3.0	4.5	0.9	1.8	5.0	6.7	1.5
Chicago, St. Paul, Minneapolis & Omaha	107.12	3.3	12	0.8	1.0	0.3	3.1	1.0	1.1	0.4
Duluth, South Shore & Atlantic	9.06	0.3	102	0.5	0.3	0.1	2.2	0.1	0.1	0.1
Iowa Central	16.77	0.5	65	0.4	0.3	0.2	2.6	0.1	0.1	0.1
Minneapolis & St. Louis	38.14	1.2	31	0.3	0.3	0.1	2.8	0.1	0.1	0.1
Wisconsin Central	24.30	0.8	59	0.7	0.6	0.3	3.4	0.2	0.1	0.1
Southern railways	297.71	9.2	198	14.5	12.6	13.3	18.7	8.4	7.4	9.4
Chesapeake & Ohio	41.16	1.3	29	2.6	1.7	2.3	2.9	1.2	0.7	1.2
Norfolk & Western	55.47	1.7	50	2.4	1.9	1.2	6.6	1.5	1.1	0.8
Louisville & Nashville	102.01	3.1	10	2.5	3.0	3.0	2.4	2.9	3.1	3.7
Missouri Pacific	56.34	1.7	14	2.9	3.4	4.5	1.9	1.8	1.9	3.1
Missouri, Kansas & Texas	21.35	0.7	46	2.4	1.6	1.2	2.4	0.6	0.4	0.3
Texas & Pacific	21.38	0.7	49	1.7	1.0	1.1	2.5	0.4	0.2	0.3
Pacific railways	371.28	11.5	119	25.5	23.8	40.8	16.7	22.9	19.1	41.2
Atchison, Topeka & Santa Fe	62.57	1.9	28	5.2	5.7	7.2	4.2	3.7	3.6	5.5
Denver & Rio Grande	23.31	0.7	40	1.6	1.3	0.4	2.2	0.4	0.3	0.1
Southern Pacific	60.96	1.9	23	8.1	7.7	8.3	3.3	5.6	4.8	6.2
Union Pacific	93.74	2.9	20	5.7	4.4	23.0	4.5	6.0	4.2	26.4
Canadian Pacific	130.70	4.1	8	4.9	4.7	1.9	2.5	7.2	6.2	3.0
Express companies, etc	523.69	16.2	49	6.7	8.0	2.3	9.1	6.8	9.8	2.1
American Express	165.39	5.1	5	0.8	2.3	0.1	2.0	1.5	3.8	0.2
United States Express	76.52	2.4	12	0.4	1.1	0.1	2.2	0.3	0.9	0.1
Wells Fargo	168.67	5.2	5	0.4	1.7	0.1	2.0	0.8	2.9	0.2
Pacific Mail Steamship	31.51	1.0	20	0.9	0.4	0.6	1.5	0.3	0.1	0.2
Western Union	81.60	2.5	7	4.2	2.5	1.4	1.4	3.9	2.1	1.4

Similarly, the index numbers of relative prices on the preceding-year base are averages of actual prices, each weighted by the multiplier, which makes its price in the year before equal 100.[1]

In weighting relative prices, then, we are weighting already-weighted actual prices. Upon the final result, therefore, each stock will have an influence proportioned, not to its figure in the formal scale of weights, but to this figure combined with its actual-price-times-another-weight. Likewise, in weighting actual prices themselves we give each stock an influence upon the result which depends, not simply on the weight, but upon the product of the weight times the price. Columns 7–10 in the table show roughly how much these "net influences" differ from the weights in columns 3–6.[2]

The first step in weighting, therefore, should be to decide what proportionate influence we wish each stock to exercise upon the final results. Of course that depends upon the end in view. For example, in measuring the changes in the market value of stocks held by investors the importance of each of our sample stocks depends both on the amount in the hands of investors and on the actual price. Weights based on amounts outstanding should therefore be applied to actual prices. If for some other purpose

1890–99 base was therefore 100 (47.70÷20.81) = 229+. But this equation may be written 47.70 (100÷20.81) = 229+; or 47.70×4.81 = 229+. The sums of the factors required to make the 1890–99 prices of each of the forty stocks = 100 is 166.63. The factor for Chesapeake & Ohio is 2.9 per cent of that sum—which is the figure for this stock entered in column 3 of Table XXI. Multiply the actual price of each stock in any year by its entry in this column, cast up the totals, divide by the sum of these multipliers times 1890–99 prices ($24,190.80), point off the proper number of places, and you have the arithmetic means of relative prices shown in Table III, column 2, barring slight discrepancies caused by the dropping of different fractions in the two computations.

[1] In computing an index number it is mainly a question of convenience whether to make relative prices by dividing by the base price and multiplying by 100, or to make the same figures by multiplying by 100 divided by the base price and to call the results weighted aggregates of actual prices. The latter course, however, has the advantage of keeping the weights used clearly before the mind and of showing just how the relative-price series differ from the original actual-price series.

[2] To show accurately the average net influence exercised upon the results by each stock, it would be necessary to carry through a computation for each year separately. But the present figures, based upon average actual prices for the whole period covered, serve well enough for the present illustrative purpose.

we think that the fluctuations of each stock should have an influence proportionate simply to the gross earnings of each corporation, then we should not apply weights based upon earnings directly to actual prices, but should first make the average actual prices of all the stocks the same for the period covered by applying one set of equalizing weights, and then multiply these equated prices by the weights based upon earnings. In this case, however, it would be quicker to begin by making the two sets of weights into one, and then to multiply the actual prices of the stocks by the consolidated weights.

In the last resort, then, the other than formal differences among the several index numbers shown in Tables I, II, and III resolve themselves into differences in the stocks included, in the methods of averaging, and in the methods of weighting. Any reader who so desires may eliminate the first two causes of differences by confining his attention to the arithmetic means of forty common stocks and then trace the peculiarities of each series back to their source by noting which stocks each series weights most heavily according to Table XXI and how these stocks have fluctuated according to Tables VIII–X. The only difficulty here is that the weighting of actual prices implicit in the percentages of change in price from one year to the next cannot be shown in a single column, because these weights vary from year to year.

XI. CONCLUSIONS

It was said in Section II, and the remark has been repeated incidentally several times, that the choice of methods in making an index number of stocks should be guided by the specific purpose in view. It follows that the index number that is best for any purpose depends upon the specific phase of price fluctuations which that purpose requires to be measured.

Strictly interpreted, this obvious but often-neglected rule bars out the question: What is the best index number at large? Perhaps there is no single series among all the stock index numbers presented above that is not "the best" for some imaginable use. But, by way of conclusion, we may point out what fluctuations in the prices of stocks can be measured with the narrowest margin of error, and argue that the index number which best represents these

most measurable fluctuations is the best "general-purpose" series; the index number to be recommended for use by the general reader, and by the specialist also, when his particular aim does not definitely demand some differently constructed series, in spite of its inferior accuracy.

Along this line a confident opinion can be given. Geometric means of the ratios of change in quotations within brief periods, such as from one year to the next, have been shown to be the most accurate measures of fluctuations in the prices of stocks. That is, Table II, column 3, gives the most trustworthy among the preceding index numbers. As a "general-purpose" series, however, this index number could be improved (1) by including preferred as well as common stocks, (2) by adding securities of other than transportation companies if quotations could be found, (3) by using geometric instead of arithmetic means in striking the average annual prices from the monthly figures, (4) by weighting the figures for each stock in accordance with average earnings or amount of stocks outstanding, and (5) by using geometric means in computing these weights.

For measuring fluctuations covering longer periods of time geometric means are again the most representative averages. But the farther apart grow the years between which price comparisons are made the less accurate grow the results obtained from a given body of quotations and the smaller grows the list of stocks for which continuous series of quotations can be had. It is true that the successive percentages of change in price from one year to the next can be multiplied into each other to make a continuous "chain index"; but, while each link has a narrow margin of error, the errors are cumulative, so that a comparison between the two ends of the chain becomes less trustworthy the longer the chain is made.[1] Of course the same difficulty inheres in the relative

[1] Geometric means are particularly well adapted to the making of such chain indexes. Say that in a chain series 1890 has an index of 100 and 1915 one of 125. The 25 per cent gain represents a quarter of the prices of 1890 or a fifth of the prices of 1915, though twenty-four separate ratios to prices in other years have been used in passing from 1890 to 1915. But if arithmetic means have been used, the meaning of the figure for 1915 in terms of prices in 1890 (or in 1915) has been hopelessly obscured. Compare "The Making and Using of Index Numbers," p. 38.

prices on a fixed base that may be made from the geometric means of actual prices. No refinement of methods can mend the fundamental defect of the data: the ratios of change in stock prices between years far apart are so widely and irregularly scattered that no average made from them can have a high representative value.[1]

The best way to diminish, since we cannot remove, this difficulty is to break the long periods up into parts, to compute fresh index numbers for each part, and to string these index numbers together. The advantages of this shift are (1) that a larger "sample" of stocks with continuous quotations can be had for short periods, and (2) that the fixed-base relatives will show a less irregular distribution. Pushed to extremes, this course would lead to the making of a geometric-mean index number of all stocks quoted both in 1890 and in 1891, of a second index number of all stocks quoted both in 1891 and in 1892, and so on to date. The main defect of such a series, after the yearly percentages had been linked together in a chain index, would be that no one could be sure what part of the fluctuations shown was due to change in prices and what part to changes in the stocks quoted. Hence price comparisons between 1890 and 1915 would still be dubious. Perhaps a middle course is the least objectionable: Make a new index number from a new sample of stocks every ten or twenty years, using geometric means; each time that a new series is made compute overlapping figures for a few years both from the old and from the new samples; find what part of the changes in those years is due to alterations in the list of stocks, and, finally, allow for these differences as well as may be in joining the two index numbers together. The price comparisons that could be extended in this way over long periods of time would not indeed possess the accuracy of our year-to-year figures, but they would be more trustworthy than any of the fixed-base series given above.

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[1] Compare Table XVIII.

SOME IMPENDING NATIONAL PROBLEMS[1]

Few will, I think, deny that the present war marks the close of one historical epoch and the beginning of another. It will probably always be of some interest in the annals of the University of Chicago that its Twenty-fifth Anniversary falls approximately at this dividing point in history.

The reconstruction of Europe will involve the solution of numerous complex and gigantic problems in which our country must necessarily figure and by which it is certain to be profoundly affected.

The problems which we Americans will have to face will not be altogether or even principally new. For the most part they will be old problems, though more acute and pressing than before. And even when the problems themselves are not more pressing, the world-war will have given us a new stimulus to solve them.

Today is a time of self-examination for us in America. The havoc of Europe has rudely disturbed our tranquil dreams of secure isolation and careless, irresponsible, trusting-to-luck. We are all asking ourselves whether our house does not need to be put in order and, if so, where and how. The general problem of preparedness confronts us. We are asking how best can we safeguard our life as a nation, the lives and wealth of our citizens, and our institutions. We are beginning to question the stability of many social conditions and arrangements which we had assumed as a matter of course to be indestructible. We are even asking if we are after all a united nation, or simply a heterogeneous collection of other nationalities and of discordant special interests.

Most of these questions have an economic side, although they are not exclusively economic; they are also political, racial, social, and even religious. It would be difficult, and it would also, I believe, be undesirable, to dissect out completely the economic elements for separate consideration. At any rate, when we attempt,

[1] An address on the occasion of the Quarter-Centennial of the University of Chicago, June, 1916.

in practice, to solve any national problem we cannot confine ourselves to a single one of its many sides. I shall not, therefore, feel obliged to restrict myself wholly to economic considerations, but shall simply endeavor, from the standpoint of an economist, to lay before you some of the great impending national problems, as I see them.

First of all, there is the problem of future peace and war. Of the economic aspects of this problem, I shall mention only one, but that one is crucial. The basic economic condition from which war arises is international trade, and international trade leads to war in three ways.

In the first place, it is itself an apple of discord, a bone of contention, a prize for which the nations, whether advisedly or inadvisedly, do eagerly and selfishly strive.

In the second place, international trade, quite apart from being itself a prize to strive for, affords, incidentally, countless occasions for friction and disagreement.

In the third place, international trade leads to war by bringing nations within shorter military distance. Modern trade has caused inventions which increase speed in transportation and communication. These devices become immediately and necessarily available for army and navy mobilization, thus giving to a single hour as great strategic importance as a week possessed in former times.

We might almost call international commerce the mother of war. It is certainly a fertile cause. This thesis, that commerce causes conflict, is amply justified by recent history, but is in striking contrast with the predictions of the early economists. They believed devoutly that commerce would prevent war. Cobden, the great free trader, proclaimed this idea emphatically and enthusiastically. And yet it is easy to show that he was wrong both in theory and practice. International commerce is today four times what it was in Cobden's day, but the risk of war has not declined. On the contrary, it has grown greater at substantially the same pace. It is true that commerce makes the *need* for peace greater. But it makes the *probability* of peace less.

It does not require much observation to see that international commerce has been an important cause, if not *the* important cause,

of the present war, and in all three of the ways just stated. The Balkans were coveted by Russia as the gateway through which her foreign commerce should reach the open sea. Germany wished to prevent Russia from acquiring such a commercial outlet, but wished for herself a clear trade route to Bagdad and India. She also coveted Belgium for her commercial sea connections. France desired to regain Alsace and Lorraine, not simply for sentiment's sake, but also for the sake of their coal and iron. Japan and Germany had opposing commercial interests in China, and almost all of the warring nations had opposing commercial interests in Africa. "Commercial and colonial expansion," "the freedom of the seas," and "our place in the sun" are phrases standing largely, if not mainly, for economic interests, real or imaginary. These are some of the apples of discord, the bones of contention, the prizes to be seized.

Again, in striving for these prizes there have been incidental friction and irritation. So-called international "incidents" relating to or growing out of commercial contact have threatened war repeatedly. After the Algeciras incident, many on both sides believed war sooner or later inevitable. So also we ourselves have very nearly been drawn into the conflict (and may still be drawn in before it is finished) because of contact incidental to commercial intercourse. The "Lusitania" case and all the other cases over which we have had friction with Germany or the other powers obviously grew out of international commerce.

Finally, as none will deny, the shortening of international distances has led Germany and France, and all the rest, to set up larger and larger military and naval establishments. These have both led to war and given it its giant character.

In fact, the fundamental condition out of which this war grew was that the nations of the earth had become too close neighbors. As a consequence of being thrown so close to its neighbors each nation felt increasingly the necessity of defending itself against them. Each increasingly realized how continually closer the enemy was to her gates. And indeed, no one nation could afford to go defenseless when neighboring nations were only a few hours distant. Thus the railway, the steamship, the automobile, the telegraph,

the telephone, the wireless, by virtually removing the natural barriers between nations—mountains, oceans, and long distances—have necessarily and naturally led to the erection in place of these natural barriers, of artificial barriers, that is, fortifications, armaments, and navies. And the worst of it is, as fast as any one nation has increased its own military strength its neighbors have only the more strenuously increased theirs; whereupon the first nation was forced to a still further increase. The result has been a mad race in armaments and navies, which, in the end, has left the nations in substantially the same *relative* positions that they would have been in had there been no increase of armament whatever.

And yet the pacifists are quite wrong in thinking that any one nation could profitably keep out of such a race. To do so would not deter the others, but, on the contrary, give them the very chance they coveted to get ahead. The benefit from withdrawing from the race would accrue to those who remained in the race. And we cannot yet conceive of a nation acting against its own interests for the benefit of others. In short, when independent and rival nations are close neighbors they mutually compel each other to compete in armaments, although this competition, from the standpoint of the *common* good, is both futile and costly.

And after this war is over, what is to prevent a repetition of the same competition in armaments, culminating in war? England talks about crushing the militarism of Germany as though such a crushing would insure lasting peace. But even if Germany should be destroyed, were that possible, a similar rivalry in armament would inevitably spring up among the remaining nations. Moreover Germany, even if crushed, will surely rise again, just as Prussia did after Napoleon thought he had crushed her and definitely limited her standing army. In fact, the recent racing in armament which culminated in the present war really had its origin a century ago from the desire of Prussia to evade the restrictions on her military strength laid upon her by Napoleon. Crushing one nation will not solve the problem of competitive armaments.

And what of our own country? Can we ourselves afford to keep out of the competition? To me the answer seems as plain as the multiplication table. So long as the other nations compete

in armaments the United States must do so also. The advice of the extreme pacifists represents simply the survival of ideas of national defense which were entirely proper before we were near Europe, but are out of date today. We have become so used to thinking of the Atlantic Ocean as an almost impassable barrier that we can scarcely realize how near to Europe, and in fact to Asia, we have grown, and how rapidly.

Moreover, if we are looking forward to the future, we must take into account that inventions which abridge distance have not yet reached their limit. Already, I am credibly informed, an inventor has devised a new type of boat, a sort of skate or glider which has actually developed a speed of sixty miles an hour and is expected, before it is perfected, to attain seventy-five miles per hour! The friend who gave me this information naïvely remarked that this boat would probably, in another decade, be of great value to the navy of the United States. It did not seem to occur to him that, if so, it will also be of equal value to all the navies of the world, and therefore of no value to any of them. On the contrary, it will be a source of new naval burdens on all. It will bring our own nation within forty-eight hours of Europe and so destroy half the protective virtue of the Atlantic Ocean.

International racing in armaments is, in the political world, quite analogous to the "cut-throat" competition with which the economists are familiar in the business world. For instance, before the days of the Interstate Commerce Commission a trans-continental railroad was often forced into cut-throat competition with other parallel roads. As long as other roads competed, no one road could keep out of the competition. If it did, it would lose *all* of its traffic and be worse off than if it engaged in the competition and merely lost *some* of it. Yet the net result of railroad rate wars was always a loss to the railroads as a whole and usually to every individual competitor. The only cure for a rate war was a rate agreement or combination of some sort. As all economists know, our modern industrial combinations are largely the outgrowth of just such cut-throat competition and were established for the express purpose of remedying that evil. It is the natural and proper remedy. And it is the natural and proper remedy for

modern militarism and war. What is needed is an international political combination of some sort, such as a League to Enforce Peace. Without some such arrangement for action in the common interest, not only must America enter on a policy of preparedness, but it will also surely happen that the cost of international military competition will, in future generations, grow greater, not less, and wars more frequent and disastrous, not less. The United States is now too close to the rest of the world to continue to pursue a policy of isolation. *We must either compete with the rest or combine with the rest.* There are only these two horns of the dilemma. There is no middle course.

A consciousness of this dilemma seems to be appearing in Congress in the adoption of a recommendation by the House Committee on Naval Affairs authorizing the President to "invite all great governments of the world to send representatives to a conference, which shall be charged with the duty of suggesting an Organization, Court of Arbitration, or other bodies, to which questions between nations shall be referred for settlement, and to consider the question of disarmament and to submit their recommendations to their respective governments for approval." This is the resolution of Representative Hensley and has, I believe, a much more far-reaching significance than has as yet been appreciated. The time has come when the two alternative proposals, cut-throat competition or combination, should be put plainly before the people and the world. We should make it clear to all nations that as long as they engage in their mad race in naval and military power, the United States also will compete. We can stand such competition better than other nations because we are without the fearful handicaps which the war has brought to them. We thus have it in our power to bring home to the rest of the world the supreme folly from the standpoint of world-economy of armament racing, and so to prepare the minds of all for the only other alternative, which is infinitely better for all concerned. In this way by offering other nations *both* alternatives, we escape suspicion of designs of conquest, and at the same time put ourselves in a position almost to dictate a policy of peace. Certainly our counsels will be more attentively listened to if other nations realize that a

failure to listen to them will mean for them a more costly and more hopeless military competition than ever before.

It is noteworthy that, already, on the announcement that President Wilson was to advocate a policy of preparedness, speakers in the British House of Commons expressed great regret and stated that such a policy on our part would lay a grievous economic burden on all the nations of Europe in their endeavor to keep up with or ahead of us.

Only by agreement shall we reach disarmament. It was by agreement that Sweden and Norway avoided fortifying their boundary. The same was true as between Chile and the Argentine, and as between Canada and the United States.

The agreement as to Canada and the United States was made ninety-nine years ago but has endured uninterrupted to the present time. It reads in part as follows:

> The naval force to be maintained upon the American lakes by His Majesty and the Government of the United States shall henceforth be confined to the following vessels:
>
> On Lake Ontario, to one vessel not exceeding 100 tons burden and armed with one 18-pound cannon.
>
> On the upper lakes, to two vessels not exceeding like burden each and armed with like force.
>
> On the waters of Lake Champlain, to one vessel not exceeding like burden and armed with like force.
>
> All other vessels on these lakes shall be forthwith dismantled, and no other vessels of war shall be there built or armed.

Now if President Monroe was able to make such an arrangement between Canada and the United States, which has saved untold millions of dollars to both nations, why cannot President Wilson, or his successor, whoever he may be, achieve a corresponding result, commensurable with the needs of the time?

The simple truth is, we cannot have international intercourse without international law. The real disease of Europe today, of which militarism is merely the symptom, is the hypertrophy of international commerce relatively to international law or government.

When international control has reached a sufficient stage of development, we may then be able virtually to have realized the

dream of economists for generations—universal free trade. And international commerce will then become, as Cobden expected it to become, a cause, not of international friction, but of international union.

I should add that, since the foregoing was written, President Wilson has delivered his famous speech before the League to Enforce Peace in which he has in substance taken the same position. This fact takes the proposal for an international agreement out of the academic realm into the realm of practical politics.

Next to the self-preservation of the nation is the self-preservation of its citizens. Turning then from foreign to domestic problems we have first of all the still unsolved problem of the conservation of our natural resources on which all our economic prosperity depends. The National Academy of Science has recently recognized, by a medal, the important services of Gifford Pinchot to his country in bringing conservation so prominently before our people. Unfortunately, since Congress, actuated apparently by petty spite against President Roosevelt and by virtue of the influence of special interests, allowed the National Conservation Commission to die of inanition, that is, of lack of funds, the conservation movement has not progressed much. As the novelty of the idea wore off, the National Conservation Congress lost its popular support and, though the fact is not yet generally realized, has recently been captured and controlled by some of the very special interests it was designed to oppose! I refer to the water-power interests. The university and all far-sighted citizens should endeavor to rescue and reconstitute this important movement, lest our children's children shall lack their proper heritage of wood, oil, copper, and other mineral deposits, be forced to pay monopoly rates for the use of water power after coal becomes scarce, and suffer a reduction in their numbers or in their individual standards of comfort because of a progressively impoverished soil. We all draw our nourishment from a little top layer of soil a few inches in thickness. Our farmers themselves, by wrong methods of plowing or by failure to make terraces or other safeguards against soil-wash, lose every year an appreciable fraction of this precious film of mother

earth and by ignorant or reckless methods of cropping, deplete it of its phosphorous, nitrogen, and potash.

But for every failure to conserve our natural resources there is in some measure an appropriate remedy. Before it is too late this remedy should be applied, and unless it is applied through the efforts of the government, it will be too late before it can be applied at all. At the present time we do not have more than half of the timber we once had, and another generation may see wood really scarce and dear. It has been estimated by some that our available supply of coal will be exhausted in one hundred and fifty years at the present rate of waste. This is doubtless too low an estimate, but the supply is limited, and consequently must be conserved to the greatest degree possible. Three-quarters of a century will see the end of our petroleum, even if we continue its use only at the present rate of consumption. Natural gas, it is believed, is within twenty-five years of exhaustion.

Rome seemed to be enjoying splendid prosperity as long as she was eating up the resources of her colonies. But there is a day of reckoning for any country which destroys the goose that lays the golden egg. To prevent this calamity we need in essence to apply whatever has not already been applied of the detailed program of the old Conservation Commission.

We have also allowed our natural resources to be monopolized, thereby immensely aggravating the problem of the control of wealth by large capitalists and large corporations. In fact, the basis of modern monopolistic advantage is largely to be found in the control of natural resources.

But our greatest national resource is "the human factor." Are we conserving our labor power, that is, our national vitality? Important efforts are certainly being put forth in this direction; and yet we may say that, in general, the problem is given but scant attention. Our very effort to increase what we call our productive efficiency is tending to impair it, in the end, by sacrificing the human factor to the mechanical factor. Our vital resources should be conserved, if for no other reason, simply to increase our power to secure wealth. They should also be conserved in order that we may have a "citizen soldiery" fit for the

national defense. But, most important of all, they should be conserved because it is only for the sake of the human factor that we produce wealth at all. If our industrial system stunts our children, cripples our men, and enervates our women, it becomes not man's servant but his tyrant. The examinations of the Life Extension Institute would tend to indicate that 99 per cent of our industrial population show some slight signs of physical decay, partly from wrong working conditions, partly from wrong standards of living. After many years' study of this problem of vital economy, I am convinced that human life can be extended enormously in length and, if I may so say, also in breadth and depth, if we will but apply the teachings of modern science. To do so will solve, not only a large part of our great economic problems, but also a large part of our political, social, and racial problems as well. If we do not attend to the human factor, we shall some day wake up to find that much of what we call progress is really retrogression in disguise.

The truth is that, at bottom, our most important economic problems are problems of human physiology.

For instance, the problem of the food supply—the basic problem of economics—is rooted in human physiology. One of the boasts of civilization is the abundance and variety of our food, and yet it is to this very abundance and variety that we must attribute a large number of the degenerative diseases which afflict the human organism. It is through this that our teeth become diseased and invite disease throughout the body, because our food is not hard enough to give them exercise. This is Nature's revenge for our attempt to grind our food by machinery instead of by our teeth. Mr. Hoffman, in his exhaustive treatise on the statistics of cancer, has established a strong presumption that this frightful malady is due in large part to what we have falsely regarded as a sign of economic strength, surfeiting the human animal with food, especially with meat and other highly nitrogenous foods.

Again, turning to the housing problem, we find another commentary on what we call progress. Civilization boasts of the economic advantages of houses. But as an offset to the good which houses have done, we have the dreadful scourge of tuberculosis, a

house disease, especially frequent where over-crowding and dark-roomed tenements abound. Many of our most devoted workers for the conservation of human life, like the late Dr. Sachs of Chicago, have applied themselves to this one problem which is incidental to what we call or miscall the "progress" of our large cities.

Again, economists have for generations boasted of the economy arising from the division of labor; but the division of labor has produced one-sided workmen, over-exercising some of their faculties and under-exercising others, and has deprived them in large measure of the normal satisfactions of life, including the satisfaction of the instinct of workmanship. This is for the simple reason that under the division of labor the workman's work becomes too impersonal and diffused for him to isolate his own part and to take pride in its accomplishment.

Again, man has invented numerous kinds of drugs; but these have proved in general a curse rather than a blessing. In particular, the habitual use of alcohol and morphine, including their use in so-called patent medicines, should be discontinued. This must be done largely by educating the public to a knowledge of modern scientific medicine. But it cannot be done completely without the application of force.

In spite of a strong original prejudice in favor of allowing wide individual liberty, I have come to the conclusion that legal prohibitions have an important place here. It is doubtful if the Chinese would ever have become emancipated from opium without compulsion brought to bear upon the individual, or whether Russia, except under pressure, would ever have become emancipated from alcohol. Although it is not yet generally known in this country, it would appear from the testimony of Ernest Gordon and Dr. A. Karlgren that prohibition in Russia has already wrought a miracle upon the Russian people physically, mentally, morally, and economically. The increase in the people's savings alone has amounted to one-sixth of the cost of the war to Russia. The amount deposited in 1915 in Russia in the state savings banks was twenty times that deposited in 1913. The loans made by pawnbrokers are said on good authority to have decreased one-half. To me the most telling result has been the added output of

labor since prohibition. We find the Russian Minister of Finance saying: "In the coal regions we have sent 30 per cent of the male inhabitants to the war and yet the output of work is greater by 30 per cent, because everyone is sober." He further adds, "Heads of large concerns employing labor have said they would pay in cold cash the sums necessary to cover the deficit in revenue, and could afford it easily from the larger incomes derived from the increased capacity of employees." Reports from the city of Petrograd state that whereas about 19,000 poor persons have annually been assisted by the city, that number is now reduced to about 2,000 a year.

The well-fed, well-clothed appearance of the peasants generally is noted by all visitors as well as inhabitants of Russia. The peasants themselves seem to realize the boon that has been conferred upon them. Gordon in his *Russian Prohibition* quotes one as saying, when a return to vodka was suggested: "No! It is better without it. We should have had prohibition before. Had there been no vodka from the time of the Liberation [of the serfs] we should have lived like lords long ago."

With our present knowledge coming from our university laboratories as to the harmful effects of alcohol on all organic cells and the rapidly growing sentiment to deal drastically with this evil, we are evidently fast getting ready for national prohibition, and, for my part, I shall be glad when it comes. If educated people will emancipate themselves from ancient fallacies on the subject and abide by the indubitable findings of science, we may make prohibition almost as effective as Russia has made it, and if we do we shall see a rapid and immediate response in the form of a diminution of poverty and its accompaniments, vice and crime.

In my opinion, the economists have made a mistake in ignoring the practical problems of consumption. In a money-balance sheet we must, it is true, inventory our distilleries as we inventory our factories or our schools, but we should not be satisfied with a mere money inventory. The real economic problems are the problems which have to do with welfare, and we must judge the true gain or loss accruing to humanity from any agency according to the effect of that agency on our welfare. Wealth which produces

poverty is not wealth. Much of what we call wealth and traffic in wealth in the United States should be classed with the old opium traffic or the white slave traffic as predatory, not constructive, impoverishing, not enriching the people.

Another and equally important measure for improving our national vitality is health insurance for working men. A committee of the American Association for Labor Legislation has worked out a well-considered plan for health insurance, combining the best features of the systems of the nations of Europe, several of which have put us to shame by applying this principle of social insurance long before we have even seriously considered it. The value of health insurance lies not simply in the insurance principle of indemnification against loss. It lies even more in the preventive principle, in stimulating employers, employees, and the state, among which three parties the expense is divided, to study and apply health-producing devices. The effect will be to reduce disease, just as the effect of workmen's compensation laws has been to reduce accidents.

Another important measure for the future is the creation of a National Department of Health, on which I have said much elsewhere. These and other well-chosen forms of social legislation, by lessening disease and disability, will lessen vice, crime, and poverty.

This brings us to the outer fringe of that great and baffling economic problem, the problem of the distribution of wealth, the problem of the rich and the poor. Various analyses, especially those of Professor King of the University of Wisconsin, show that something like two-thirds of our population have no capital except the clothes on their backs and a little furniture and personal belongings, while the major part of our capital is owned by less than 2 per cent of the population. In respect to income, the situation is, of course, not so bad. We may say that about half of our national income is received by one-fourth of our population, the other half being distributed among the other three-fourths. There is evidence to show that this inequality of wealth is increasing and that it is greater in the cities than in the country. Still more distressing is the fact that, in recent years, the income of the

poor, the average wages of the country (reckoned in commodities, not money) has not quite held its own, but has slightly decreased.

Up to about 1890, it could be said that the wage-earner had not only shared in the increased prosperity of the country, but that he had gained ground faster than his employer. Between 1890 and 1900 both gained, the employer somewhat faster than the employee. But thus far in the present century the employer has continued to gain while the employee has remained substantially stationary.

Such a progressive change for the worse is a matter of grave concern, especially in a democracy. Can we remain a democracy in theory without remaining a democracy in fact? It must not be overlooked that we adopted the democratic theory of government chiefly because, when we adopted it, we were really democratic in fact. As long as there was an abundance of land we could approximately realize the eighteenth-century philosophy of liberty, equality, fraternity. Abundance of land makes for independence of spirit, for the simple reason that it affords a safety valve or means of escape for anyone who is, or thinks himself, oppressed. If a servant or employee did not like the treatment he received at the hands of his master or employer, he could until recently, "go west" and take up a farm. Consequently the master or employer, whether naturally considerate or not, was forced to be so. Otherwise he would have no employees.

Undoubtedly the most democratizing influence in history was the discovery of America, by which a new continent was added to the available land supply of mankind. It has been such addition to the land area of Europe as was brought about by the opening up of North and South America, of Australia and Africa, that, through four centuries, has, step by step, advanced the democratic ideal until now even China and Russia have felt the reflex effect. It has been our boast that we, in America, have realized this ideal more perfectly than any other nation in history. Certainly we are engaged in the greatest of historical experiments, the noble experiment of a government of the people, by the people, and for the people. But, unfortunately, we cannot yet boast of a really

efficient democracy. Shall we succeed in making it efficient in the face of a reversal of those conditions which gave rise to democracy?

Today the lackey of Fifth Avenue or the factory worker of Pittsburgh has so slight a chance of successfully escaping to a western farm of his own, that it does not enter into his calculations. Whatever his lot is or the indignities he may receive, he must "grin and bear it", or, at any rate, bear it. The situation is complicated by the fact that, besides the concentration of wealth that is slowly going on, there has been also a concentration of control, which has been proceeding by leaps and bounds. The device of the corporation, facilitated by modern easy and rapid transportation and communication, has made possible aggregations of capital never dreamed of by the founders of this republic. A handful of men in our great financial centers now controls, if the truth were known, a large part, if not the larger part, of the capital of the country. In short, we are fast developing into an economic plutocracy and our problem, in a nutshell, is, *Can we maintain an economic plutocracy side by side with a political democracy?*

Lincoln asked, half a century ago, whether this country could exist half-slave and half-free, and we may in another half-century have to ask, can it exist with a small minority rich and a large majority poor? With the economic ownership concentrated so largely in 2 per cent of us and economic control in a fraction of 1 per cent, while the political power is diffused and therefore chiefly in the hands of the poor, it is clear that we have an unstable condition. It is, in fact, largely out of this anomaly that our corruption in politics proceeds. The politician is a sort of unscrupulous broker between these two great powers. He contrives, directly or indirectly, to get graft from the plutocracy, while using what is necessary of this graft for securing, by fair means or foul, the votes of the democracy.

The plutocrat does not, of course, usually deal directly with the poor voter but with the politician, nor are his expenditures all corrupt; but the fact remains that he uses his wealth to secure for himself special privileges. That is, the money which he expends for these objects is expended with the purpose of inducing the ordinary voter to vote in such a way as will bring special privileges

to himself. The great body of the voters on the other hand aims to use its power to shift the burden of taxation through the income tax or otherwise, upon the upper 1 per cent. In short, these two great powers, the economic and the political, are fighting for supremacy, although neither is distinctly conscious of the situation.

In ancient times we have usually found economic power and political power both concentrated in the same hands, as it is still in Russia, for instance. That was a fairly stable condition. On the other hand, our country, a hundred years ago, had a diffusion of economic power as well as of political power. This also was a stable condition. Is the unstable condition of today in which the economic power is concentrated while the political power is diffused merely a transition stage in a big swing of the pendulum back to a government by a plutocracy? This I conceive to be the most serious economic and political question which America will have to face in the twentieth century. All of us who have it at heart to fulfil the wish of Abraham Lincoln, "that government of the people, by the people, for the people, shall not perish from the earth" should be setting ourselves about this task.

But if the solution is not to be found in the establishment of a political plutocracy, is it to be found in the opposite pole of socialism?

The problem is far too vast for me upon this occasion to more than touch its outer edges. I shall content myself with noting three among the various partial remedies which seem available.

In the first place, there is some reassurance in the fact that the absolute loss which the wage-earner has suffered during the last decade and a half has been due, not to fundamental scarcities, but to a shrinkage in our monetary yardstick. When prices rise, wages usually fail to rise as fast as they should in order to restore the balance. This means that in the last fifteen years the workman has lost through the depreciation of the dollar. I have written so much on this subject elsewhere that I will pass it over here. Suffice it therefore to say that, just as the customer at a grocery may unconsciously lose because of short weight or measure, so all purchasers may be losers through what may be called a shrinking dollar; and, just as standard weights and measures are necessary

to preserve justice in trading, so a standardizing of the dollar is necessary for the just settlement of all contracts and for preventing an otherwise inevitable disturbance in the distribution of wealth. I have shown to the satisfaction of myself at least and, I may add, to the satisfaction of many others well fitted to judge, that this problem can be solved, and without abandoning gold as the redemption-basis. Unfortunately, the necessity or even desirability of any solution is not as yet generally conceded. It is to be expected, however, that, in the period of reconstruction following this war, the subject of monetary standards will come up in many of its phases.

A second controllable factor in the distribution of wealth is immigration. The immigration problem, of late years, has grown into something quite different from what it was a generation ago. After the present war it seems likely to become even more different from what we have known it to be in the past. As long as there was plenty of land, immigration benefited those already here, as much as it benefited the immigrant coming here. Again, as long as immigration was difficult and expensive and, therefore, small in volume, the body of immigrants was easily assimilated and could not demoralize our standards of living. But today immigration is so vast, so heterogeneous, and so cheap, while our remaining unused land supply is so small, that it aggravates our political and economic problems in an extreme degree. The melting-pot is getting choked. The result is not an amalgam but a heterogeneous mass. The important result will be an improvement in the condition of the immigrant but a degradation in the condition of the majority of Americans. I should be the last to preach a policy of mere national selfishness; but if, as is not so far from the truth, unrestricted immigration means progressive impoverishment of the American laborer, I should consider it tantamount to national suicide. I am disposed to believe that, even from the standpoint of benefiting humanity as a whole, quite irrespective of our own national point of view, America will accomplish more by maintaining her high standards of living than by accepting the low standards of other countries. I, therefore, think, though with great regret, that by a policy of restricting immigration by exclu-

sion of those unfit to become American citizens, physically, mentally, or morally, or in ideas, intelligence, or education, we shall help solve some of our great problems, including that of the distribution of wealth.

A third controllable factor in the distribution of wealth is inheritance. It is far more important to level up from the bottom than to level down from the top and yet, in a democracy, it is important that the top should not be allowed to separate itself from democracy to form a self-appointed aristocracy.

The real menace from great wealth to democratic ideals has scarcely yet made its appearance in this country. This is the danger of an *hereditary* plutocracy. Americans still admire the self-made man and, unless they believe that he has won his wealth dishonestly, dislike him far less than they dislike the man whose wealth came to him through no merit of his own, but merely by accident of birth. The American ideal is not, or is not yet, at least, one of equality of wealth, but of equality of opportunity. Americans, therefore, like to see the millionaire leave his wealth for public purposes, but dislike to see him leave it for the demoralization of his sons or for bartering his daughters to foreign noblemen. They also dislike to see the growing tendency among American millionaires to imitate the English system of primogeniture in order to insure the maintenance of the family name and fortune through future generations.

Of the various ways proposed for dealing with this problem, the best and simplest beginning can be made by increasing inheritance taxes. This will not, as some objectors have maintained, decrease in any important degree, if at all, the motive for accumulation. Most large fortunes are accumulated for the love of accumulation and not for the sake of leaving them to future generations. On the contrary, the ordinary normal, self-made American millionaire is rather disposed, I believe, to look on the inheritance of his millions by his children with some misgiving.

The problems which I have passed in review are problems which must be solved in order that America may continue to enjoy economic prosperity. They are the problems of insuring the peaceful pursuit of international commerce, of conserving the

natural resources from which wealth originates; of improving the human efficiency by which wealth is produced, and of preventing or mitigating the inequality in the distribution of wealth.

I have, of course, not named in this brief review all the economic problems of progress in American life. I have not even exhausted the list of important problems. Much less have I treated any one problem exhaustively or given complete solutions or attempted to give complete or convincing proof that my solutions are the best. The remedies I have suggested often amount to little more, in their initial stages at least, than palliatives, but most of them have the merit of being capable of adoption by gradual stages and of being carried farther if experience justifies the policy. This quality of elasticity is a political necessity in most reforms in a democracy. I am convinced that unless those of us who are conservative and would maintain, if possible, American institutions for future centuries do resolutely and steadily push forward toward these reforms, the alternative of neglect will bring an accumulation of pressure which some day will greatly weaken, if indeed it does not ruin, our beloved nation.

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TRADE AND INDUSTRY IN IRELAND IN THE SIXTEENTH CENTURY

It will be convenient to classify Irish trade in the sixteenth century into four divisions, to treat each division separately, and then to summarize results. The basis of classification is economic as well as geographic, and comprises: (1) the English Pale; (2) the southern part of Ireland (the province of Munster and part of Leinster); (3) Connaught (the western province); (4) Ulster (the North of Ireland).

(1) The English Pale in the fifteenth and sixteenth centuries was that part of Ireland in which the majority of the inhabitants were of English birth or descent and in which English law was current and English customs prevalent. The border line was a variable one, but in general we mean by the English Pale the four counties of Dublin, Kildare, Meath,[1] and Louth (often spoken of as Uriell). This part of the country, extending inland some twenty or thirty miles and north and south about fifty miles, was distinctively English.[2] Its chief cities, Dublin and Drogheda, had been settled by men from Bristol[3] and other English cities in the twelfth and thirteenth centuries. The former city became the headquarters of the English administrative system and very rapidly developed into a thriving trade center.[4] The patronage

[1] The western part of Meath was organized as a separate county, Westmeath (Statute 34° Henry VIII), and in the latter half of the sixteenth century was included in the Pale.

[2] The policy of maintaining this English dominance was deliberately adopted by these Bristol traders and their descendants. In 1453 it was enacted by the Dublin Assembly "that all manner men of Irish blood and women, that is to say Irish nonnys, Irish clerks and Irish Journay men, Irish prentyses, servants and beggeris, men, women and children, also all manner of Irish householders, except those that be living within the city 12 years, that they and every of them avoyde by this day 4 weeks, any that may be found within the city after that shall forfeit, goods, cattle and be put in prison."—*Cal. of Ancient Records of Dublin* (ed. Gilbert), (referred to hereafter as *Dublin Records*), I, 280.

[3] *Ibid.*, I, 1–2 (Charter of Henry I and its confirmation by John); *ibid.*, II, 542: "diverse citizens of Bristol flitted from thence to Dublin."

[4] Morris in his history of Chester in the fifteenth and sixteenth centuries states that the trade between Chester and the Irish towns had been opened up as early as the ninth century (Morris, *Chester*, p. 457).

of the early Angevin kings protected and fostered its trading relations with Bristol, Chester, Liverpool, London, and other English cities and towns.[1] Since Dublin was the center of administration, its population was constantly being added to by newcomers of English birth, men sometimes of high rank, accustomed to the best of everything in England, and very unwilling to lower their standard of living in Ireland. These men and those of lesser rank holding various civil and military positions came into Ireland in large numbers, brought their families, and settled down in city and country districts. It was this fact which made the trade of the English Pale different from that of other parts of Ireland. There was always a demand, not only for English commodities, but for such foreign luxuries as men of this class were accustomed to enjoy in England. All through the later Middle Ages Dublin was a lively, flourishing town, with an active trade in all sorts of English,[2] French,[3] Flemish,[4] and oriental[5] commodities. Twice a year, in the sixteenth century, its merchants went to Bristol Fair,[6] and brought thence Flemish wares, silks, groceries, merceries, spices, dates, figs, and dyestuffs. In both Dublin and Drogheda there was a flourishing import trade in salt, iron, wine, and coal[7] and an export trade in

[1] Cf. an order to mayor, bailiffs, and collectors of customs at Dublin not to exact toll on sheepskins and hides brought to that city by burgesses and merchants of Bristol (*Dublin Records*, I, 11). Henry II granted to his burgesses of Dublin freedom from toll, pontage, murage, etc., and all customs for themselves and their goods throughout his entire land of England, Normandy, Wales, and Ireland, *ibid.*, I, 1.

[2] *Calendar of Carew MSS*, 1603–24, p. 108; *Dublin Records*, I, 25.

[3] *Dublin Records*, I, 15: "cloth of Normandy"; *ibid.*, p. 233: wood "from Caen, Amiens, and from Vermand."

[4] *Ibid.*, I, 15: "cloth of Flanders and Brabant."

[5] *Ibid.*, I, 16: "figs, dates, raisins."

[6] *Cal. Carew MSS*, 1603–24, p. 138.

[7] Foreign merchants bringing in iron, salt, wine, or coal had to offer their cargoes to the four buyers of the city, and if these did not agree on a price they had to hold their merchandise for forty days and then sell to whomsoever they pleased (*Dublin Records*, I, 299). This custom of community bargains was quite evidently derived from Chester precedent (see Morris, *Chester*, p. 390). "Merchants of Chester shall not sell salt on shipboard, it must be landed and housed before sale."—*Dublin Records*, I, 221. Cf. prohibition against merchants bringing in salt, iron, wine, and other

hides,[1] linen yarn,[2] woolen yarn, skins of all kinds, tallow, Irish rugs,[3] blankets or coverlets, and the shaggy, fringed mantells which were peculiar to the country. In 1611 Robert Cogan, inspector of the Irish customs, valued the Dublin trade at £100,000 and the

merchandise (grain excepted) from the coasts or other parts beyond the sea but such "as shall be his or their own proper goods and merchandise" (*ibid.*, II, 14).

A list of commodities bought and sold in the Dublin market, compiled from charters of the fourteenth century and customs lists of the same period, reveals the following:

corn	cloth	iron of Bristol	carts	figs
malt	canvas	iron of Spain	brewing-vessels	dates
cattle	Irish linen	cloth of Flanders	millstones from Wales	buge (fur)
hides	pitch	cloth of Normandy	salmon	tar
sheep	buckram	cloth of Brabant	herring	glass
wool	caldrons	English cloth	butter	silk
wool fells	onions	horseshoes	iron	slates
other fells	alum	nails	lead	madder
deer hides	ashes	shears	tin	chalk
goatskin	wine	kitchenware	copper	wax
Irish frieze	honey	ploughshares	coals	boards
Irish rugs	fish	timber	salt	
salt fish	tallow			

[1] Regulations of the Dublin Assembly in regard to the tanning of hides and their sale to foreigners are very numerous all through the sixteenth century. The Tanners' Guild was one of the largest and most important in the city (*ibid.*, I and II, *passim*). Numerous city charters gave Dublin citizens customs privileges, of which that on hides was seemingly very important. Cf. also the reference to Irish trade in "The Libel of English Policy," *Political Poems and Songs* (Rolls Series), I, 187.

[2] *Itinerary of Fines Moryson* (ed. 1617), Part III, 160: "Ireland yields much flax, which the inhabitants work into yarn and export the same in great quantity, and of old they had such plenty of linen cloth as the wild Irish used to wear, 30 or 40 ells in a shirt all gathered and wrinkled and washed in saffron because they never put them off till they were worn out." Cf. also Beverly to Walsingham, April 30, 1586, "Yarn Exported to Manchester," *Cal. S. P. Ireland*, Eliz., 1586–88, p. 50. Cf. also the following from the Dublin Assembly Roll of 1582: "Whereas the linen drapers or such as were accustomed to sell linen cloth in the markets of this city being forreners are now to be forbidden the same."—*Dublin Records*, II, 167.

[3] Entries in the port register of Chester, 17° Henry VIII:

Introitus Navis Vocate –le Michael de Dublyn, magister Ricardus Bresall.
Wattherus Barbe 11 packes sheepe fells.
Joh'es Chambres 11 packes yarn—Rugges, chekers, lamb fells and 1 doz. mantells.
Will Neuman 4 pks yarn, chekers, sheepe fells, goat and fox felles and 7 diker hides.
Johnes Bennett—4 pks yard, chekers, Ruggs, Mantells, blankets, fells, linen cloth and 1 flock bed.
Nickers Hankok—201 gr'ts yarn, chekers and mantells.
Rob'tus Bailiffs—5 packs Rugges, chekers, lynen cloth, etc.

There were seven other partners having stock in this venture, each one getting "Ruggs, chekers, mantells and fells" of various kinds.

In the 30° Henry VIII "Le Mare Rose" was registered in the port of Chester and had for cargo "martin skynnes, chekers, blankets mantells and caddows [coverlets]."—Morris, *Chester*, p. 479.

trade of all the rest of Ireland at £110,000.[1] He estimated Dublin's imports at £80,000 and her exports at £20,000. In the same year he set the Drogheda trade at one-fifth as much as that of Dublin.[2] From the commercial point of view Drogheda was far less favorably situated for trade development. It was a frontier town of some size and of importance as a distributing center not so much of English as of Irish trade. Its chief exports were hides, yarn, wool, fells, and tallow, in return for which it received much wine,[3] both French and Spanish, and some few English and other commodities.

In Dublin the merchants were an organized body,[4] very active in municipal affairs, and influential enough to bring pressure to bear on English members of the Privy Council.[5] Their commercial policy was one of protection. Foreign merchants, it is true, were admitted to the market, but they were debarred from the retail trade and were subjected, of course, to the jealous scrutiny of the local guilds.[6] In spite of this limitation the trade was of enough importance to attract merchants from the cities and towns of Brittany, Southern France, and the Netherlands. Some of these acquired the franchise,[7] and thus the right to participate in retail as well as wholesale trade. But in general the policy of the native traders was one of rigid exclusiveness designed to secure an absolute monopoly of both local and retail trade.[8]

[1] *Cal. Carew MSS*, 1603–24, p. 175. [2] *Ibid.*

[3] Perrot to Walsingham, February 15, 1586, *Cal. S. P. Ireland*, Eliz., 1586–88, p. 28.

[4] *Dublin Records*, I, *passim*.

[5] "Whereas the sum of £500 hath been disbursed by the brethren of the Trinity Guild for prosecuting of sundry suits in England through which the Queen's Majesty had granted to the whole corporation of this city certain immunities."—*Ibid.*, II, 167.

[6] Cf. enactments against foreigners exercising arts in the city; foreigners were not to sell except by wholesale. "No forreyner shall kepe shop or exercise any art craft faculty or science in this city without permission by the Mayor and 6 Aldermen."—*Ibid.*, pp. 457–59. Cf. also, in 1551, petition of freemen for enforcement of the law against foreign trade (*ibid.*, p. 427).

[7] Fiants. Eliz., Nos. 364, 403, 1058, *Report of the Deputy Keeper of Records in Ireland*, XI, Appendix: Grant of English liberty to Melchior Baeldefitz; Walbrane Baede, merchant, born at Ipres in Flanders; Grant of English liberty to Lawrence Roner, goldsmith, and John Haws, carpenter, Germans; Grant of English liberty to Pier Trembler of Rosseponte, coppersmith, a Frenchman, and his issue.

[8] In the records of the Dublin Assembly there is some slight indication of protest against such a policy.

With regard to English merchants as distinct from aliens, the Englishman in Ireland was upon the same footing in matters of trade privileges as the native Irish. So far, at any rate, as Dublin merchants were concerned, the same rule applied to Irishmen in England. Indeed, during the Middle Ages it is pretty clear that Dublin merchants enjoyed exemption even from local tolls in the English towns with which they had trade relations.[1] In the sixteenth century, however, there is evidence of a disposition on the part of some English towns to collect customs from Irish merchants. The Irish protested—with what success does not appear.[2] The controversy is nevertheless interesting, because it reveals the fact that even as early as the sixteenth century the English were beginning to discriminate against the Irish in matters of trade privileges.

From the evidence of early charters and customs lists of the thirteenth and fourteenth centuries, from the frequent references in the state papers of the fifteenth and sixteenth centuries, and, lastly, from the report of Robert Cogan in 1611, we have enough data to justify the statement that the trade of the English Pale was distinctively an English trade.[3] The majority of the people were English by birth and breeding. What they had to eat and to wear was obtained through the medium of English and continental markets and fairs.[4] The English Pale was but England in miniature, at least inside the walls of its chief city. Of this its charters, customs lists, and guild regulations are convincing proof.

[1] The first Dublin charters give to the citizens exemption in all parts of the king's dominions. This policy was adopted by John and the later Angevin kings (*Dublin Records*, I, 1–37).

[2] Petition to Burghley that the Irish merchants may not pay customs at Chester and Liverpool, 1582 (*Cal. S. P. Ireland*, Eliz., 1574–85, p. 417).

[3] "From England the importation is greater than the export out of Ireland because Ireland hath not commodities of many kinds to fit England as England hath to serve Ireland, especially Dublin, which is supplied from hence with cloth and all sorts of Flemish wares, lawns, cambrics, etc."—*Cal. Carew MSS*, 1603–24, p. 138.

[4] Even marmalade, the most indispensable adjunct of an English breakfast, was not unknown in Ireland in the sixteenth century, as witness the following: "Pardon to James Cantwell, burgess or merchant hitherto dwelling at Baltinglas, for receiving goods from suspected persons, especially for buying two boxes of a confection of quinces, pears and plums called Marmelot. Fiants. Eliz., No. 327, *Report of Deputy Keeper of Records in Ireland*, XI, Appendix.

MUNSTER AND SOUTH LEINSTER

In the southern part of Ireland we get a different kind of trade. This part of the country was distinctively Irish; the early settlers had become so thoroughly assimilated with the native population that they were frequently spoken of as "more Irish than the Irish." This was the country of the Desmonds and the Butlers, two powerful Anglo-Irish families, whose constant quarrels kept the country in unrest and hindered the development of peaceful industries. The chief cities and towns were Waterford, Cork, Wexford, Ross, Kinsale, Youghal, and Limerick. Some of these traced their origin back to the period of Danish occupation,[1] and throughout the later Middle Ages and in the fifteenth and sixteenth centuries were lively centers of trading activity.[2] In 1611 Robert Cogan spoke of Waterford as the second city for trade in Ireland. Its exports and imports he valued at £30,000.[3] Its merchants, like those of Dublin and Drogheda, did a certain amount of trading in the English towns, especially Bristol, but by far the greater part of its commercial intercourse seems to have been with the Netherlands,[4] with Southern and Western France,[5] and particularly with Spain[6] and Portugal.[7] All through this period Waterford was noted for its production of Irish rugs or coverlets,[8] and these constituted an important item of the export trade. Other commodities, exported chiefly to France and Spain, were hides,[9] fresh and

[1] Orpen, *Ireland under the Normans*, II, 335–40.

[2] "Certain Portingales have arrived."—*Cal. S. P., Ireland*, Eliz., 1509–73, p. 83 (1548); "A Flanders ship has arrived."—*Ibid.*, p. 100 (1549); "The Spanish Merchants and their factor Madriage shall have justice."—*Ibid.*, p. 307 (1566).

[3] *Cal. Carew MSS*, 1603–24, p. 175.

[4] January 20, 1549, *Cal. S. P. Ireland*, Eliz., 1509–73, p. 100.

[5] *Cal. Carew MSS*, 1603–24, p. 207; *ibid.*, 1601–3, p. 128.

[6] *Cal. S. P. Spanish*, Eliz., 1567–79, p. 165; cf. also n. 5 above. All through the latter half of the sixteenth century Waterford advertisements of news from Spain are so numerous as to indicate much coming and going.

[7] *Cal. S. P. Ireland*, Eliz., 1509–73, p. 380.

[8] "I pray you provide for me half a dozen of the finest and lightest Irish rugs to lay upon beds that can be gotten."—Sir George Heneage, Vice Chamberlain, to Sir George Carew, December 22, 1590 (*Cal. Carew MSS*, 1589–1600, p. 47). Cf. also Bagwell, *Ireland under the Tudors*, III, 448.

[9] *Cal. Carew MSS*, 1603–24, p. 175.

tanned, tallow, Irish frieze, some timber, pipe staves, herrings, hake, and salmon.[1] Cork, the second city of the southern province, also did a large export trade in hides,[2] Irish woolen goods, fells, and fish.[3] Wexford, in the southern part of Leinster, owed its importance to the herring fisheries along the coast and also furnished timber of good quality (with which Westminster Hall was roofed in the fourteenth century), pipe staves, some Irish cloth, and also hides. Limerick, the third largest city of Munster, was situated on the banks of the river Shannon. Its chief export commodity was fish, particularly salmon, for which the Shannon River was famous then as now. In the smaller towns of Munster there was just about the same kind of trade. Spanish fishing-fleets are mentioned as coming annually to Dingle-Cush and Baltimore.

The chief import commodity of the larger cities and the smaller port towns in this region was, first and last, wine.[4] The English settlers attributed the excessive consumption of wines and native liquors to the humors of the climate. Whatever the cause, wine was without question the chief item of the import trade in all parts of the country. In the thirteenth and fourteenth centuries the wine imported at Dublin and Drogheda was mainly French, in accordance with the prevalent taste of the English in the Pale.

[1] "For in former years there hath been accustomed to come thither a-fishing two or three thousand."—Perrot to Walsingham, December 16, 1587, *Cal. S. P. Ireland*, Eliz., 1586–88, p. 447.

[2] "Cork's trade during the period of the wars amounts to about 100 lasts per annum (value £10,000);" (Cork in this period had absorbed the trade of a group of small towns in southern Munster).—*Cal. Carew MSS*, 1603–24, p. 207.

[3] The whole coast of West Cork and South Kerry was then frequented by fishermen from Spain and France; it was, in fact, to those countries what Iceland and Newfoundland are now, the source from which they drew a great deal of their provisions for the Lenten season ("Town Life in Mediaeval Ireland," *Irish Arch. Soc.*, III, 83). In 1553 Philip II agreed to pay £1,000 a year for twenty-one years to gain for his subjects the right to fish on the Irish coast (Bagwell, *Ireland under the Tudors*, III, 447). Bagwell gives no authority for this statement.

[4] *Cal. Carew MSS*, 1603–24, *passim*. "Her Majesty's impost of wines and customs should be renewed by Parliament and some defects helpen that were in the act expired concerning the great quantity of aqua vitae bastards and Canary wines brought into this country. The impost of wines rise to the sum of £1,000 and 1,000 tuns of Spanish wine are brought yearly into the provinces."—*Ibid.*, 1575–88, pp. 285–86.

In the sixteenth century there is some indication that even in those ports the French wine trade was decreasing in importance and had begun to be superseded by that with Spain and Portugal. In Southern Ireland geographic and economic factors had fostered from the very beginning a close trading relationship with the countries of Southern Europe.[1] The Spanish fishing-vessels brought cargoes of wine and found a ready market in the cities and towns of the southern coast. Salt, iron, English and Flemish commodities, such as pewter ware, silks, groceries, merceries, and dyestuffs, formed also a large part of the import trade.[2] Both Waterford and Cork had some trade with the Netherlands and with France, but their most important trade was that with Spain. The Spanish kings might declare war, the English government might issue prohibitory proclamations,[3] but in spite of all kinds of hindrances there does not seem to have been any great interruption of trading relations between the two countries. In the latter part of the sixteenth century there was a decrease in the volume of both exports and imports, due to the wasted and impoverished condition of Munster after the Desmond rebellion, but no change apparently in trade routes. Not only did Irish merchants come and go without hindrance in all parts of Spain, but Spanish merchants had free access to the ports and havens of Southern and Western Ireland. Even when England and Spain were openly at war, merchants from Spain were constantly arriving in Waterford. Indeed, the English government drew much of its information about military and naval preparations in Spain through that channel. On the other hand, of course, the intimate commercial relations between Southwest Ireland and Spain afforded the

[1] "One Kyst a merchant of this town (Waterford) this day arrived here out of Lisbon, saith that at his first coming thither he meant to pretend himself and his goods to be French, as some few English there do, but perceiving that all Irish men had free traffic there and safe access, he shewed himself to be as he was and so was freely communicated of all things that his countrymen knew."—Perrot to Walsingham, February 7,1585/6, *Cal. S. P. Ireland*, Eliz., 1586–88, p. 25.

[2] Robert Cogan's Report, in 1611, *Cal. Carew MSS*, 1603–24, p. 174.

[3] Proclamation against traffic with Spain, March 10, 1602: "As traffic with Spain leads to the bringing of letters, messages, priests and seditious persons into the country."—*Tudor and Stuart Proclamations* (ed. Steele), II, 15.

Spaniards an easy opportunity to foster Irish disaffection toward English rule, and may be reckoned perhaps among the factors which contributed to the various rebellions in Ireland under Elizabeth.

CONNAUGHT

Connaught, the western province of Ireland, was in the fifteenth and sixteenth centuries a wild and desolate country with few trading commodities, except those provided by nature rather than industry. Its most important, in fact its only city, Galway, must be excepted from such a general statement. Galway was distinctively an English town. Its citizens, all through the three centuries of their corporate existence, had prided themselves on their English origin and had jealously excluded the wild Irish of the vicinity from the privileges of citizenship.[1] Galway in the fifteenth and sixteenth centuries was a walled city of stately homes and prosperous merchants. It was, in fact, the outpost of English civilization in Western Ireland, although it owed its prosperity in large measure to its commercial relations with the continent of Europe.[2]

The great industry of Western Ireland was fishing. The bays and inlets along its coast were among the best fishing-grounds in Europe for herring, cod, and ling and hake. Its rivers yielded large quantities of salmon and other choice fresh-water varieties. It is said that Spanish fleets of 600 sails came annually to Ireland to traffic in fish alone,[3] and that the king of Spain in 1553 was willing to pay £1,000 a year for the fishing privilege in Irish waters.[4] Bretons, Portuguese, and English fishermen were hardly less eager to share the trade.[5] Indeed, there can be little doubt that in the fifteenth and sixteenth centuries the fishing-grounds of Western Ireland were as much coveted by European fishermen as were

[1] "The daring spirits who built up that early Galway were English and they desired nothing less than to be mingled with the inhabitants of the land and to learn their ways."—Callwell's *Old Irish Life*, pp. 1–27.

[2] *Ibid.*, p. 3.

[3] "Great traffic yearly of the Spaniards with Ireland at the least with 600 sails of ships and barks for fishing only."—*Cal. Carew MSS*, I, 422.

[4] Bagwell, *op. cit.*, III, 447.

[5] "Galway Bay. The English, Bretons and Portingalls had a great trade here of fishing for cod, ling, hake and conger."—*Cal. Carew MSS*, IV, 296.

those of Newfoundland in the century following. It is not possible to determine how much of the fishing in these waters was carried on by the native Irish, but it was doubtless enough to provide a substantial quantity of fish for export trade. Most of this trade fell to Galway because of the favorable location of her fine harbor, and because of the fact that she had no rival port in the west to compete with her. Her merchants also managed to build up a considerable traffic with the back country in hides, skins, and other raw products obtained from the wild Irish. In addition to these the weavers of the city itself produced certain commodities which commanded a steady market abroad, notably Galway mantells, Irish friezes, rugs, and coverlets. The export trade of this port may be taken to represent that of Connaught as a whole, which Galway practically monopolized. Briefly, then, the West of Ireland in the sixteenth century exported hides, skins, linen products of the back country, the woven fabrics for which Galway, like Waterford, was famous, and, above all, fish.[1]

The imports were wine and salt; iron, chiefly from Spain, and English and Flemish commodities. The wealthy merchants of Galway were as gorgeously attired and as well fed as their brethren of Dublin.[2] And so Flemish merceries as well as oriental spices, dates, figs, raisins, dyestuffs, etc., were not the least important items of exchange.[3] There are, however, many indications that Galway no longer occupied at the end of the sixteenth century the position in Irish commerce which had caused her to be reckoned one of the chief cities of Ireland in the fourteenth century. Political and economic factors conspired together to debase her. Her trade was disorganized by the Irish rebellions of the sixteenth century, and her chief customer was cut off by the Elizabethan wars with

[1] *Cal. Carew MSS*, 1603–24, pp. 174–75. Callwell, *op. cit.*, p. 5.

[2] The customs lists in various Galway charters indicate the extent and variety of the trade of Galway in the fourteenth and fifteenth centuries:

ginger	alum	English cloth	peas	wheat	hawks	other skins
saffron	iron	Irish cloth	beans	corn	calves	eels
pepper	sables	Spanish iron	wooden plat-	butter	cows	horses
cloves	silk	kitchenware	ters	salt	herrings	coal
other spices	goats	spike nails	oxen	tallow	wool fells	salmon
wax	tanned hides	barley	wine	honey	lambskins	dry fish
sheep	pack-horses		malt			

[3] *Cal. Carew MSS*, 1603–24, p. 174.

Spain. She suffered most of all perhaps from the increasing competition of the Newfoundland fishing-banks.

ULSTER

Ulster, the northern province, was in this period the least civilized part of Ireland. It was the country of the O'Neills and the O'Donnells, a province which possessed no corporate towns and few markets. For this reason it is difficult to estimate the extent or the value of its trade, but, as in every other part of Ireland, there was a consuming thirst and, in consequence, a traffic in wine, in exchange for which the merchants from Galway and from France received hides and cattle.[1] The northern coast had an extensive fishing trade, exploited largely by fishermen from Brittany[2] and Western France. Some of the rivers also, especially the Bann,[3] had an abundance of salmon and other fish, which made the fishing privilege there not one to be despised. The out islands of Scotland,[4] off the northern coast, also furnished hides and fish in abundance for such merchants as found the trade of enough importance to venture so far north. The unsettled state of Ulster

[1] "In Carrickfergus twice a week a good market was kept, where, out of the English Pale, the Isle of Man, and Scotland came much merchandise, victuals, and other commodities out of France and in one summer 3 barks of 40 tuns apiece discharged their loading of excellent good Gascony wine, the which they sold for 9 cowskins the hogshead."—*Ibid.*, II, 342. O'Neill is said to have kept usually in his cellars at Dungannon 200 tuns of wine (Holinshed [ed. 1809], VI, 331). "O'Donnell is the second best lord in Ulster and hath lords under him as the said O'Neill hath. He is best lord of fish in Ireland and he exchangeth fish always with foreign merchants for wine by which he is called in other countries the king of fish."—*Cal. Carew MSS*, II, 308.

[2] "There was long since at Port Rush a fishing used by the Bretons in France who came thither every season for dog fish and rays which being well handled are a very great commodity in Spain, especially in the condado for there they are sold by weight and bought by them of Castilia la vieza Cordana, Salamanca."—*Ibid.*, vol. 1603–24, p. 152.

[3] "License for the fishing of the Bann. Rent £40. (Provided he be able to enjoy it in quiet.)" Fiants. Eliz., No. 6413, *Deputy Keeper's Report*, XVII, Appendix. "Salmon fishing of Loughfoyle and the Bann. The owners esteem it worth £800 or £1,000 per annum."—*Cal. Carew MSS*, 1603–24, p. 153.

[4] "From the Derrie and Skerries, Portrush is but a cut over into the Isles of Scotland where there are great fishings and great store of other commodities as cattle, hides, wool, etc."—*Ibid.*, p. 152.

prevented the development of its natural resources, and so its trade was of comparatively little importance.

GENERAL TRADE

A very interesting export trade, which is hard to localize, was that in hobbies, hackneys, and hawks. In the last decade of the fifteenth century the agent of an Italian duke got a license from Henry VII to cross over into Ireland to purchase hobbies.[1] Evidently the experiment was successful, for in 1527 the Duke of Ferrara instructed his agent to purchase (with the king's permission) eight hobby mares and two hobby stallions for breeding purposes. Hurronimo Ferofino, the agent, seems to have had some difficulties, for in 1528 he wrote that "the blessed and tedious hobby mares have arrived on this side of the sea."[2] That the trade had become quite extensive is shown by the proclamation, issued in 1580, prohibiting transportation to France and Scotland.[3] Hawks of the breed of Ireland seem to have been considered very desirable and were frequently sent by public men in Ireland to their friends in England. The high value of hawks is illustrated by an enactment of the Dublin Assembly in 1573 providing that Mr. Nicholas Fitzimmons "shall have allowance of £8 sterling for a goshawck, which hawk died."[4]

To summarize, then, the export trade of Ireland consisted of: hides, tanned and fresh; fish—herrings, hake, salmon, cod, ling, eels, dried fish; yarn, linen and woolen; Irish cloths—friezes, rugs, coverlets, and mantells, linen cloth; timber, pipe staves; fur, hides; fells—deer, lamb, sheep, coney, marten, goat; tallow, wax, and honey.

The imports were: wine from Gascony, Brittany, Spain, Portugal, and the Canaries; salt—a necessity in the fishing industry; iron, chiefly from Spain; sea-coal, for Dublin and its vicinity, brought from England and Wales.

[1] *Cal. State Papers Venetian*, 1557–58, Appendix, p. 1603.

[2] *Ibid.*, pp. 1610–11.

[3] Lords Justices to the Privy Council, "We pray you not to mislike our proclamation against the passing over of horses, the scarcity is so extreme. The number daily transported to Scotland and France under pretense to be sent to England is very great [January 17, 1580]."—*Cal. Carew MSS*, 1575–88, p. 201.

[4] *Dublin Records*, II, 82.

The imports into the English Pale and into Cork, Galway, Waterford, and Limerick may be classified as follows: English commodities, a general term including articles bought in the English fairs; Flemish commodities, also a general term, applied not only to the products of the Netherlands, but to such articles as formed a customary part of their overland trade from the orient and the Mediterranean countries; dyestuffs—saffron, Toulouse woad, alum; kitchen utensils, and implements of various kinds.

The carrying trade into and out of Ireland was pretty equally divided between the merchants of its own cities and those of other countries. Men from Dublin, Waterford, Cork, Drogheda, and Galway were found in England, Flanders, France, and Spain, and merchants from those countries were familiar figures in every Irish city. The fishing industry and trade seems to have been partly in the hands of foreigners, and was considered by them a privilege of considerable value.

The value of the Irish trade during this period is difficult to estimate. The wine custom of Galway was farmed for £600 per annum, that of Cork for £550, that of Limerick and its havens for £520. In 1593 Henry Bronckard paid £2,000 for the farm of the whole custom.[1] It is probable that this sum was somewhat less than the actual value of the custom, though thrifty Elizabeth did not, as a rule, allow her "customers" a very wide margin of profit.

The fishing industry, being partly in the hands of foreigners, was less easily controlled, and its value therefore is an uncertain quantity. As for the other chief export, hides, there is no possibility of estimating either the customs value or its total amount until the beginning of the seventeenth century. In 1611 Robert Aston petitioned the king for permission to export raw hides and to pay £800 for the privilege.[2] This petition, and also a proposition to prohibit the export altogether, led to protests which give some idea of the importance of the trade.

> The number of hides that are transported is far greater than that, that is supposed although haply it may not appear to the general officer, for they are secretly and at unseen creeks transported to the great loss of the king's custom. The great vent they have for these hides is at St. Malo's in France, where

[1] Fiants. Eliz., 1593, No. 5956, *Deputy Keeper's Report*, XVI, Appendix.

[2] *Cal. Carew MSS*, 1603–24, p. 203 (Robert Aston's plot).

they sell the raw hides at 10*s.* a piece, tanned hides at 15*s.* They also send hides sometimes to Lisbon, but mostly to Seville and the Canaries, where they fetch the same price as in France.[1]

Cork's annual export was about a hundred lasts a year, which at this price would be worth £10,000.

Sir William Petty, in his *Political Anatomy of Ireland* (1672), speaks of Irish trade as follows:

> If it be true that there are but about 16,000 families in Ireland, who have above one chimney in their houses and 180,000 others (who live in smoak-houses), it will be easily understood what the trade of this latter sort can be, who use few commodities and those such as almost every one can make and produce. That is to say men live in such Cottages as themselves can make in three or four days; eat such food as they buy not from others; wear such clothes, as the wool of their own sheep, spun into yarn by themselves, doth make, their shoes called brogues are but a quarter so much worth as English shoes nor of more than a quarter in real use and value.[2]

INDUSTRY IN TOWN AND COUNTRY

In Dublin, as in other English cities of the fifteenth and sixteenth centuries, trades and crafts were organized and freedom of the city meant membership in some one of the numerous guilds.[3] As early as 1498 we get a list of the guilds taking part in the Corpus Christi pageant of that year.[4] Later on other guilds came into existence, and in the sixteenth century the franchise lists indicate the existence of a surprisingly large number.[5] Of all the city organizations that of the Trinity Guild was the most important. Its members were merchant traders and in due time became alder-

[1] *Cal. Carew MSS, loc. cit.*

[2] *Economic Writings of Sir William Petty* (ed. Hull), I, 88.

[3] *Dublin Records*, I, 34.

[4] Guilds taking part in the pageant of Corpus Christi, Dublin, 1498: glovers, vinters, weavers, bakers, masons, tanners, stainers, coopers, cooks, tailors, mariners, smiths, slaters, skinners, painters, barbers, butchers, shoemakers, goldsmiths, merchants, salmon-takers, spearmen, house-carpenters, fishermen, ship-carpenters, broiderers, porters (*Dublin Records*, I, 239).

[5] Saddlers, cutlers, barber surgeons (incorporated by Elizabeth), apothecaries, pewtrers, glasiers, fishmongers, hat-makers, dyers, millers, corvisiers, haberdashers, plasterers, wheelers, curriers, heliers, girdlers, sailors, smiths, brickmakers, farriers, plumbers, tallow-chandlers, button-makers, tanners, musicians, joiners, masons (*ibid.*, I and II. Taken from franchise lists here and there in the sixteenth century).

men and members of the Dublin Assembly. Its regulations in regard to trade and membership were like those of similar guilds in English cities. Apprenticeship was strictly controlled, since membership was esteemed a high privilege. Dublin merchants, like those of Bristol, dressed in gorgeous gowns upon occasions of state and worthily upheld the civic dignity of their town. Craft guilds had become very numerous in Dublin and were apparently well organized in the sixteenth century. Their policy, like that of the traders, was distinctly one of protection. The infant industries of the city had to be protected, and so we find prohibitions against buying outside of Dublin such ready-made articles as could be made by the men of the different faculties within the city itself.

In all of the other cities of Ireland merchant and craft guilds were organized as completely as in England. They had their own regulations for membership and for protection of the local trade. The tanners' guilds were specially regulated by statute.[1] Bad workmanship had to be guarded against, and so the regulations were not only those of the guild and of the city but also those of the Privy Council. Inspectors and say-masters were appointed, and rigid rules were enforced in regard not only to the use of materials but also to the method of curing and of packing.[2] This industry in the Elizabethan period had become of national importance as a source of revenue, and so we find great activity in its regulation.

Outside the towns industry was, of course, "domestic" in character. In the regions immediately adjacent to the towns there probably was, in Ireland as in England, a certain amount of industry established by the migration of discontented town artificers. Also, in Ireland as in England, these suburban workers probably constituted a dangerous menace to the guild monopoly of the town market. In 1577, for instance, the Dublin Assembly complained that the price of shoes charged by the Shoemakers' Guild was excessive and threatened, if it were not reduced, that the country shoemakers would be allowed free access to the town market. The

[1] Statutes, Ireland 11° Eliz., c. 2 (*Irish Statutes*, I, 316).

[2] Fiants. Eliz., Nos. 6,745, 2,457, 2,213, 2,451, and many others.

next year, for similar reasons, the Dublin glovers were similarly warned. Yet of course these suburban industries were exotics fostered by the more or less Anglicized industrial conditions within the Pale. The native Irish country industry was quite another matter, and was certainly not at all concerned with such foreign luxuries as gloves and shoes. The coarse woven Irish friezes and the rugs, "mantells," and coverlets for which Ireland was famous were probably in the main the product of the country weaver, though some of the finer varieties, like Waterford rugs and Galway mantells, may have been woven in the cities. Of the linen industry, which plays so large a part in the later history of the island, only the beginnings are discernible in the sixteenth century. It is apparent that the government was anxious to encourage its growth.[1] But the success of its efforts is questionable. At any rate it is certain that Ireland was still exporting a considerable amount of linen yarn and still importing much of the linen cloth that went into the making of the folded linen head-dresses of the Irish women and the pleated "saffron" shirts of the Irish men. Some interesting light is thrown upon the state of the linen industry in Ireland by the following document which, though undated in the original, probably belongs to the latter part of the sixteenth century:

A brief Declaration concerning Transportation of Linen Yarn.

The transportation of linen yarn out of Ireland was prohibited by Act of Parliament to the intent that the Irish should procure English weavers to dwell there, that the people might be occupied in making of linen cloth, a matter often attempted but will take no hold. For albeit the Irish people will take a little pains to sow flax and make yarn, yet long experience hath made good proof that the Irish will not make any store of cloth, no not so much by a great deal as they do very needfully use. The Irish people do greatly pleasure and profit themselves by selling their yarn to the Irish merchants by the pound weight. And the Irish merchants receive like profits by gathering and making the same from pounds into parts. But the town of Manchester doth reap most profit thereby, having many years since entertained great trade. The men, women and children of that town and the country round about do set themselves dayly to work to make the yarn into linen cloth, and other merchandise greatly to their profit, and are the only people of England that are most perfect in the handling of Irish yarn. The Irish merchants gain little

[1] Cf. *Irish Statutes*, 13 Eliz., c. 2 (ed., 1786, I, 380-81).

or nothing by the transportation of the yarn but their gain (when it hapneth) by the return of the English commodities into Ireland. Therefore there must be a care had what rate is sett on imposts in every port for the linen. The ordinary rate hath been *3d.* or *4d.* upon the pack. . . . . The merchants' and mariners' profit did consist in that this did bring commodities to Dublin from Liverpool, Manchester, Chester and ports where they trade. So if it please Her Majesty to stop or stay this linen traffic it delayeth shipping and loseth her custom whereby is great profit. Irish merchants and poor people who have no other trade, her Majesty shall thereby suddenly bring into decay, her town of Manchester and its people there standing mostly upon this trade.[1]

In the early Tudor period there had been an interesting attempt (1552) by the English government to exploit the mineral resources of Ireland. A German[2] company of miners had been sent to Wexford County and had begun to work the silver and lead mines of that district. Nothing was accomplished, however; the promoters were accused of being wasteful in their methods, and the project was abandoned. In the latter part of the century Walter Peppard and a group of gentlemen obtained a patent for working the Wexford mines. The results were unsatisfactory; there was much litigation, and it was not until the early part of the eighteenth century that these mines were worked with profit to anybody.

To summarize, then, the industries of the cities of Ireland were of the same kind and carried on in the same manner as like industries in England. In Dublin one might have found as many guilds and crafts as in any average English town. In the country parts the grazing of cattle and sheep, the tanning of leather, the weaving of coarse cloths, and the spinning of flax and wool made up the sum total of the native industries. Of agriculture there was relatively little. Parts of Ireland are well adapted to the cultivation of wheat and other cereals, yet sixteenth-century Ireland produced none at all for export and hardly enough for her own needs. The Elizabethan government had repeatedly to put

[1] Cotton MSS (British Museum), Vespasian F IX, 203. The handwriting is of the sixteenth century which, together with the reference to "her Majesty," fixes the date of this document in the reign of either Mary or Elizabeth. The allusion to the prohibition of the export of linen yarn out of Ireland probably refers to the law passed in the Irish parliament in 13° Elizabeth (13° Eliz., c. 2).

[2] *Cal. S. P. Ireland*, Eliz., 1509–73, pp. 121–24, 127–28, 130–31.

pressure upon the English grain-producing counties to secure supplies for the queen's forces in Ireland. The probable explanation of this condition of things lies in the disordered state of the island during the greater part of the century. There was too much raiding and rick-burning to make grain a very stable form of property. The Irish peasant preferred to invest his capital in cattle and sheep, which could be driven out of sight in times of disorder. Hides, therefore, constituted the ordinary medium of exchange. In hides rents were paid, fines imposed, and foreign traders satisfied. Both trade and industry were conditioned by a civilization which, to be sure, reached a fairly high level in the towns, but which, in the rural parts of Ireland, was still, during the Tudor period, semi-barbarous.

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BOOK REVIEWS AND NOTICES

Federal Land Grants to the States, with Special Reference to Minnesota. By MATTHIAS NORDBERG ORFIELD. (University of Minnesota Studies in the Social Sciences, No. 2.) Minneapolis: University of Minnesota, 1915. Large 8vo, pp. v+275. $1.00.

The most useful portion of this volume will be found to be Part III, which deals with the actual administration of the public lands in Minnesota. Part I, "Colonial Precedents," furnishes little that is new, while Part II, "Land Grants to the States and Territories," is important chiefly for the unusually good discussion and summary of the cases touching the authority of the federal government over the public domain (chap. xi). But what really profits us is to find out how Minnesota, one of the principal beneficiaries of our all too prodigal land policy, has acquitted itself in the stewardship of its seventeen million acres of public lands. It is indeed a sorry tale; nearly every page yields its story of fraud, of big graft and little graft, of robbery and jobbery. The state has lost so much of its grass lands, swamp lands, mineral lands, and especially of its timber lands, that it now has title to only a little over two and a half million acres of the original grants; and with one conspicuous exception it has very little to show in exchange for the rest. Most of the state timber has disappeared—some of it was sold much below its true value, a great deal of it stolen outright, and much of it lost through disastrous forest fires. Likewise, though the state has always reserved to itself the mineral rights in the public lands, it has deprived itself of a large share of the royalties on its mineral leases because of its failure to provide adequate inspection.

In striking contrast to the experience in the management of the lands is the account of the administration of the permanent trust funds derived from the sale of the school lands and others. These funds now aggregate nearly twenty-eight million dollars and are increasing at the rate of a million a year. They have been invested not only safely but profitably. Moreover, a useful system of loans to towns, counties, school districts, villages, and cities for the erection of public buildings has been inaugurated. A considerable portion of the state's own debt is held by these funds.

The author would have measurably enhanced the value of his work by adding a chapter in summary and general criticism of the Minnesota experience, and by a more judicious use of tabular statements. He has relied for his information almost wholly on statutes, reports of public officers, and the findings of official commissions of investigation. His bibliography, however, lists a number of secondary sources, but omits notably Treat's *The National Land System*, and the useful papers included in the *Collections of the Minnesota Historical Society*. The *Life, Journals, and Correspondence of Rev. Manasseh Cutler* is cited on pp. 38 and 39 (without, however, a mention of the names of the editors), but does not appear in the bibliography. Donaldson's *The Public Domain* is listed simply as "Thomas Donaldson, *The Public Domain*," without subtitle or date. On p. 66 is a gross error in the table showing the grants of salt-spring lands to the states. These and similar slips somewhat impair one's confidence in what seems to be in most respects a trustworthy as well as valuable contribution in this field.

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A History of the Family as a Social and Educational Institution. By WILLYSTINE GOODSELL. New York: Macmillan, 1915. 8vo, pp. xiv+588. $2.00.

This book marks an interesting stage in the rapid development of research and discussion concerning the family. It was only recently that this institution began to receive the attention which properly belongs to it. Already a very considerable body of literature exists, and Dr. Goodsell performs a real service by including in each chapter a bibliography of sources and secondary works with supplementary footnotes. The reader, however, misses a reference to Dewey and Tufts's discussion of the family in their *Ethics*, as well as to J. H. Tufts's later paper on "The Ethics of the Family," and to E. T. Devine's *The Family and Social Work*.

Dr. Goodsell's book is published as one of the "Text Book Series," edited by Paul Monroe, and it is frankly a textbook. The emphasis is properly upon the historical aspects, to which four hundred and fifty pages are devoted. Following these twelve chapters, which trace the family from primitive times through the nineteenth century, are chapters on "The Present Situation" and "Current Theories of Reform." It is a sign of the wholesome change which has taken place in the public atti-

tude that the author describes with frankness certain conditions associated with the family, such as prostitution and social diseases, whose treatment has heretofore marked a book as unfit for general circulation and even for college students. Indeed, the chapter dealing with the evidences of maladjustment of the modern family to social conditions, causes of disharmony within the family, the problem of the marriage rate, and the problem of the birth-rate, might well be read and studied together by every young couple intending to enter upon marriage and to establish a family. Neither in this chapter nor in the concluding one, a most valuable one on current theories of reform, does the writer permit herself to thrust forward her personal views, but keeps, to an extraordinary degree, the historical and judicial attitude. Here and there a sentence, and at the close of the book an admirable paragraph, disclose the author's independent opinions, and they are so fine and sane that the reader regrets that the apparent exigencies of textbook construction do not permit of greater fulness in this respect.

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Railway Monopoly and Rate Regulation. By ROBERT JAMES MCFALL. (Columbia University Studies, LXIX, No. 1.) New York: Longmans, Green, & Co., 1916. 8vo, pp. 223. $2.00.

The author undertakes a study of the theory involved in what railway commissioners understand as the cost-of-service principle in rate regulation. He states that the object of governmental regulation is to reduce railway rates to the level of cost; because, since a railway enterprise is a monopoly, competition may not be relied upon to force rates to this cost-of-service level.

The book consists of four chapters: In chap. i, on "Regulation of Whole-Rate Systems" the conclusion is reached that the ability of the railways to provide the service is what is to be worked out by the theory of cost, and that this theory of cost to the railways has been worked out through an attempt to allow a fair return to the railways upon a fair valuation of the property. Accordingly, chap. ii is devoted to a discussion of "Valuation as a Criterion of Railway Ability." Here is a discussion of the problem of railway valuation. Various bases of valuation are suggested, methods defined, and theories compared. It is decided that fairness, expediency, and convenience would seem to argue for the adoption of the principle of present value as the standard for the investments of the past, and for the principle of actual investment in addition to such a valuation as the standard for the future. This makes necessary the consideration of the question of "The Fair Return," which is the theme of the third chapter. After a valuation of property on the

basis of cost-of-reproduction less depreciation, the system which operates at least advantage, while still socially necessary and managed with reasonable care, should be selected, and the "fair return" would be what is necessary to warrant investment in needed betterments and extensions of the system. Chap. iv is given to a discussion of "Regulation of Particular Rates." In the conclusion the hope is expressed that we may keep railway rates down as far as the ability of the roads to supply the service will allow, but it is conceded that it may be necessary for the rates to be raised from time to time.

Auditing Theory and Practice. By ROBERT H. MONTGOMERY. 2d ed. New York: Ronald Press Co., 1916. 8vo, pp. xxvi+889. $5.00.

The most important feature of the second edition of *Auditing Theory and Practice* which distinguishes it from the edition of 1912 is the appendix of about one hundred pages dealing with the federal income tax. In this appendix the detailed provisions of the law and of the subsequent rulings of the Department of the Treasury are discussed authoritatively, and, for both individuals and corporation, the obligations, proper procedure, and allowable deductions in filing returns under the law are clearly set forth.

This appendix supersedes the chapter on "The Federal Tax on Corporations" which appeared in the first edition. The chapters on "The Auditor's Qualifications," "The Auditor's Duties," and "Ethical Duties and Legislation," and the collection of C.P.A. examination questions are also omitted. The chapter on "Liabilities of Auditors" of the first edition is summarized in the second edition in a few paragraphs upon the legal responsibility of auditors. The C.P.A. questions are now readily available to everyone; and from the omission of the other chapters mentioned the book gains in compactness and unity more than it loses from the elimination of this material, which was of such a general character as to be of little practical aid to the auditor present or prospective.

A few unimportant changes in the order of chapters and sections and a few minor additions, including the fuller treatment of systems of internal check preparation of charts, and statements required by banks, and the insertion in the chapters on balance-sheet audits of brief discussions on partnerships and acceptances, have also been made.

Because of its clear exposition and its admirable blending of the presentation of advanced auditing theory and practical suggestions, this book continues to occupy in America the highest place among general treatises upon the subject of auditing.

Capital To-Day. By HERMAN CAHN. New York: Putnam, 1915. 8vo, pp. x+313. $1.50.

The author here presents an analysis of the development of the various forms of modern capital, giving special attention to the situation in the United

States. The book begins with a brief statement of the Marxian economic theory, which, as outlined, is advanced as a valid and satisfactory explanation of present conditions. Severe criticism is directed against the common practices connected with corporate management, and our whole banking and credit system is described as leading directly toward a condition of general commercial chaos. "If the social insolvency, which is covered in ordinary parlance by the word 'credit,' cannot be denied, then we shall be confronted sooner or later with the tremendous convulsion of social bankruptcy which is to give birth to a new society" (p. 311).

It is scarcely necessary to say that agreement with Mr. Cahn involves an unqualified acceptance of the Marxian analysis. Moreover, even as a socialistic statement of the case, the book is not without obvious defects. These appear chiefly in the form of misplaced emphasis. In many instances more attention has been given to the discussion of remote possibilities than to the evidence of actual facts. It may also be noted that the book savors strongly of determinism, little or no attempt having been made to present any constructive policy which might offer hope of avoiding the cataclysm postulated as the inevitable outcome of our present capitalistic system.

Banking and Currency in Ohio before the Civil War. By CHARLES CLIFFORD HUNTINGTON. (Ohio Archaeological and Historical Publications.) Columbus, Ohio: F. J. Heer Printing Co., 1915. 8vo, pp. 312.

This book throws considerable light on the details of local banking conditions in Ohio from 1800 to 1862, a period of more or less obscurity in the financial history of the country. On the whole the work corroborates by intensive study the conclusions drawn by earlier writers concerning the condition of state banking in this period, especially the unsoundness of some of the banks themselves and the condition of the currency in the West.

The book is divided into two parts: Part I treats of "Banking under Special Charters, 1803–1843." In this part the writer treats of the inflation period of 1815–17 and the crisis of 1818, the depression and revival of 1820–30, the expansion of 1831, and the panic of 1837. Part II, entitled "Banking in Ohio under General Laws," reviews the operation of the safety-fund system, the general currency situation, and the panic of 1857.

The work does not confine its attention strictly to the banking situation, but attempts to interpret the contemporary economic and political history. In this respect it throws light on the difficulties which the second United States Bank met in Ohio, and the reasons for the prejudice that was manifested against the institution. The appendix of forty pages contains digests of important state laws and statistical tables. A valuable part of the work is the balance sheets of the state banks of Ohio shown for critical periods.

Minimum Wage Legislation in Australia. By PAUL STANLEY COLLIER. (Fourth Report of the New York Factory Investigating Commission, Appendix VIII.) Albany: J. B. Lyon Co., 1915. 8vo, pp. 417.

The movement toward the regulation of wages and the history of wage legislation in the states and the commonwealth of Australia is comprehensively outlined in this work. Victoria, New Zealand, New South Wales, Western Australia, South Australia, Queensland, Tasmania, and the commonwealth are discussed separately. In each of these states the history of the legislation, the operation and administration of the system, and the economic and social effects are discussed. The concluding chapter discusses the relative effectiveness of wage boards and compulsory arbitration, suggests the advantages and disadvantages of each of the various methods of securing minimum wage standards, and outlines the methods employed in the administration of this legislation.

Commerce and Industry. By J. RUSSELL SMITH. New York: Henry Holt & Co., 1916. 8vo, pp. viii+596. $1.40.

The author describes this book as an attempt to explain how man's industries are determined by his environment, and this statement fairly sums up the nature and scope of the work. In describing the location and growth of the various industries, the determining influences of the climatic and geographic factors have been especially emphasized. The book is divided into three parts, the first dealing with the industries of the United States, the second with those of foreign countries, and the third with the world trade routes and the nature and laws of world-commerce. The pages abound with illustrations, maps, and statistical diagrams, and these add much to the attractiveness of a work which presents a wealth of information in a very readable form and brings out clearly the fact and significance of the physiographic basis of modern industry.